Better Crops with PLANT FOOD

June-July 1939 10 Cents

The Pocket Book of Agriculture

AVAILABLE LITERATURE

The following literature on the use of fertilizers in profitable soil and crop management is available for distribution. We shall be glad to send these upon request and in reasonable amounts as long as our supply lasts.

Circulars

Potash Pays on Grain (South)
Greater Profits from Cotton
Tomatoes (General)
Asparagus (General)
Vine Crops (General)
Sweet Potatoes (General)
Southern Tobacco Recommendations
Grow More Corn (South)
Fertilizing Small Fruits (Pacific Coast)
Potash Hungry Fruit Trees (Pacific Coast)
Better Corn (Midwest) and (Northeast)
The Cow and Her Pasture (Northeast) and (Canada)
Fertilize Pastures for Better Livestock (Pacific Coast)
Winter Wheat Success (Canada)
What You Sow This Fall (Canada)
First the Field Then the Yield (Tomatoes—Canada)

Reprints

D-7 Successful Strawberry Practices in the South
H-7 Potash for Cotton in the Delta Foothills
K-7 The Tung Oil Industry in Mississippi
M-7 Better Crops of Better Quality (Corn)
N-7 Will Potash Benefit Your Apple Orchard
R-7 Results with Potash in Eastern Virginia
U-7 Fertilizers for Better Asparagus (Northeast)
X-7 On Apple Orchards Use "Congenial" Fertilizers (Northeast)
Y-7 Asparagus in Ontario
Z-7 Apply Boron to Prevent Darkening of Turnips
AA-7 Potato Improvement in Wisconsin
CC-7 Replace Plant Food Losses in Crops
HH-7 High Potash Fertilizers for Fall Use
JJ-7 Atkinson Demonstrates That It Can Be Done
LL-7 Fertilize to Control Cotton-belt Erosion
MM-7 Raising Quality Fruit on a Large Scale
NN-7 The Use of Soil Tests in Conservation
OO-7 Study Starvation Signs on Tobacco and Cotton
UU-7 Better Yields of Better Cotton
VV-7 Diagnosing Fertility Needs of Orchards
XX-7 We Met the Change in Burley Tobacco
ZZ-7 Crotalaria Is Good for Southern Soils
BBB-7 Certain Elements Affect the Growth of Turnips
B-8 Commercial Fertilizers in Grape Growing
D-8 Raising Pure-bred Seed for the South
H-8 Fertilizer Developments in Mississippi
K-8 Safeguard Fertility of Your Orchard Soils
L-8 Soil Tests Improve Canning Crops
M-8 A Primer Explaining Cotton Disease Control
P-8 Profitable Cows Need Productive Pasture
Q-8 Corn on Alkali Soils Responds to Potash
R-8 New Approaches to Potash Fertilization
S-8 Mr. Pender Specializes in Asparagus
T-8 A Balanced Fertilizer for Bright Tobacco
U-8 Tomatoes & Cucumbers Reveal Diet Needs
V-8 Our Responsibility with Manure
W-8 Red Raspberries Need Complete Fertilizer
Y-8 Potash Is Needed in Southern Illinois
Z-8 Orchards Differ in Fertilizer Needs
AA-8 Were the Professors Wrong?
BB-8 Permanent Clovers for Permanent Pastures
CC-8 How I Control Black-spot
DD-8 Cooked Potatoes Blacken Because . . . .
EE-8 Quality Potatoes from Muck Soils
FF-8 Potash Saves Alfalfa, Clover, and Soybeans
GG-8 Soil and Fertilizer Needs of Apple Orchards
II-8 Balanced Fertilizers Make Fine Oranges
JJ-8 Earn Soil Payments with Winter Legumes
KK-8 Extra Potash & Borax Grew Good Celery
LL-8 High-quality Tomatoes Must Have Potash
MM-8 How to Fertilize Cotton in Georgia
NN-8 Does Weather Affect Tomato Yields?
OO-8 Growing Sweet Potatoes in South Arkansas
PP-8 New Methods Help Tomato Growers
QQ-8 How Michigan Grows White Pea Beans
A-9 Shallow Soil Orchards Respond to Potash
B-9 Land Use as Related to Soil Fertility
C-9 Fertilizing Hops for More Profit
D-9 What Seeds Mixtures Make Better Pastures?
E-9 How to Prevent Fertilizer Burn
G-9 WPA Aids Wisconsin to Test Her Soils
H-9 Looking at Cotton from a New Viewpoint
I-9 Apparent Changes in Southern Farming
J-9 Sweepstakes Fruit Does Not Happen
K-9 Quick Tests Show Southern Soil Needs
L-9 Master Bill Barron Wins Potato Honors (Midwest)
M-9 Fertilized Ponds Produce More Fish
N-9 Problems of Feeding Cigarleaf Tobacco
O-9 Use Good Soil for Hybrid Corn
P-9 Borax for Alfalfa in Northern Idaho
Q-9 Research Replenishes Florida's Sugar Bowl
R-9 Fertilizer Freight Costs
S-9 The Importance of Potash to Southern Agriculture
T-9 Fertilizing Potatoes in New England
U-9 Why Southern Illinois Needs More Potash
V-9 There Is No Substitute for Soil Fertility
How to Determine Fertilizer Needs of Soils

AMERICAN POTASH INSTITUTE, INC.

INVESTMENT BUILDING **WASHINGTON, D. C.**

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

Editorial Office: Investment Bldg., Washington, D. C.

VOLUME XXIII NUMBER SIX

TABLE OF CONTENTS, JUNE-JULY 1939

Picnics—Pro & Con 3
Jeff Quips about Summer Leisure

Microbes as Factors in Soil Fertility 6
Recent Findings Detailed by S. C. Vandecaveye

Growing Good Tomatoes in Arkansas 12
Clifford Alston Reports the Procedure

Toward Cutting Marketing Costs 14
Practical Suggestions by C. B. Sherman

Ex-students Extend Ontario's Experiments 17
Dr. G. P. McRostie Relates Their Success

Cows and Cotton
A Story of the South, by Ben Hilbun

It Costs Little Extra to Fertilize Right 21
According to Herbert L. Garrard

Editorials 27

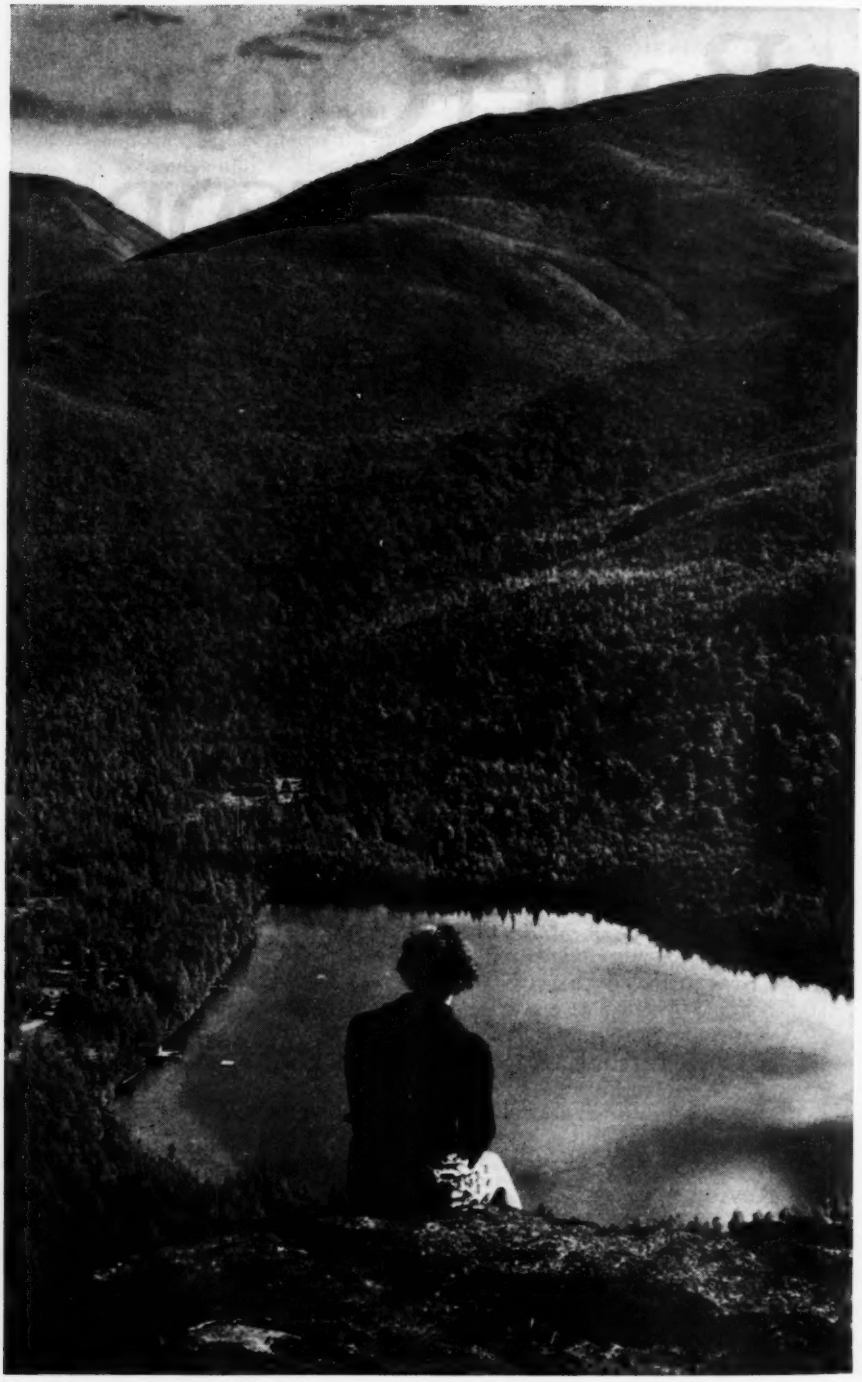
Reviews 29

Foreign Agriculture 34

American Potash Institute, Inc.
Investment Building, Washington, D. C.

J. W. TURRENTINE, *President and Treasurer*

G. J. CALLISTER, *Vice-President and Secretary*



A Vacationist's Dream Fulfilled.

Better Crops with PLANT FOOD

PUBLISHED FOR THE AMERICAN POTASH INSTITUTE, INC., INVESTMENT BUILDING, WASHINGTON, D. C., SUBSCRIPTION, $1.00 FOR 12 ISSUES; 10¢ PER COPY. COPYRIGHT, 1939, BY THE BETTER CROPS PUBLISHING CORPORATION.

VOL. XXIII WASHINGTON, D. C., JUNE-JULY 1939 No. 6

Jeff discusses the merits of

Picnics - Pro & Con

By Jeff McDermid

THERE was a time when the surest way to insult a farmer was to ask him when he expected to take a vacation. But that was prior to our acquiring sliding-gear transmission, the power take-off, and the constant surplus. With machinery to multiply his capacity and shorten his time, and a tantalizing wanderlust engendered by the motor vehicle, the commercial "cash" farmer, replete with cheap and exasperating abundance, hankers for a resting spell. He even gets travel folders along with hardware catalogs and tax bills.

One might casually wonder why he does not take that rest period during the winter solstice when nature herself takes time off to recuperate. But anybody who has ever been a small boy recalls that indescribable joy that surged through one whilst playing hooky down at the swimming hole. Official half-holidays proclaimed by the smug principal never had the zest to them that a stolen absence carried. Hence to turn your back on a fertile farm alive with quack grass and white grubs and hunt around for somebody else's outdoors to criticize is a deeply underlaid trait of human nature. Call it an escape mania, if you will, but let's not be too technical.

Another reason for summer rather than winter sojourning in distant climes

below the frost line is that it's not so easy to brag about the home climate when you must perforce return to icebergs, snow shovels, and snuffles. No traveling American is fully happy until he can point with pride at his native heath and view with alarm the abode of strangers. (And when he gets home he reverses it.)

It's just as easy to sit down and go somewhere as it is to stay at home and farm it on the seat of your pants. This is an age of doing everything partly recumbent anyhow, and because it is so simple to work up a surplus without working up a lather, there is really no need as of old to rise with the lark and roost with the chickens. You can take the extra leisure on the front stoop looking over road maps or picnic routes. Why not? For every lick you put overtime on the land you will be rewarded with a few extra tons of something that has to be doled out with scrip tickets. Maybe if we all got together and took more vacations and picnics our dilemma would be over. Until next election anyhow!

PHYSICAL weariness used to overpower our ancient farmers to such an extent that all they wanted at the day's end was a bowl of mush-and-milk and a corn-shuck mattress, with maybe a little eye-opener out of that jug that Omar prized, come morning. Physical exhaustion is the foe of vacations and educational rest-ups. Nobody ever roamed far from the rural habitat in the days of the flail and the hoe. They were self-sufficing folk—and blamed tired trying to keep that way.

But the more you rest, the more rest you want. That's why vacations are more popular these days with ruralites who are not insulted when you inquire about their speedometer reading, or ask which they liked better, Treasure Island or the glamour of Gotham. Why of course, it's just evolution. Where the ancient agriculturist had his roots in the soil, the modern farmer has his routes on the map.

Let us pose a question, despite the heat wave. Can a farmer rest successfully at home in this restless age? Urban motorists passing snug farms in sheltered vernal valleys usually dilate upon the peaceful, restful, calm, and heavenly surroundings. Apparently they think that farmers spend most of their time gazing at scenery or lolling within reach of a fishing rod and a mint julep. At any rate, the flat dwellers sigh for a home in the wilds and vow they'll retire some day, settle down in the sticks somewhere and write best sellers about their queer neighbors and early squash.

SURELY in such green pastures anybody ought to live in a perpetual vacation from raucous noise and distracting bewilderments. Then why do farmers talk so much about parity and the tariff, and get red-hot and bung-eyed amid salubrious sunsets and cheeping songsters? Why not stay right at home and relax professionally?

If relaxing was as simple as laxatives I suppose every farmer would be fit as a fiddle. But it isn't a mere matter of rhubarb and exercise. It's a mental state which peace and purgatives do not always reach effectively. Isolated farm homes are a thing of the past, and even though the main highways are smooth and inviting, a great many visitors detour betimes to interview or sell the side-road farmer or his wife on countless items unknown a generation ago. And if they can't go out, they jangle the telephone.

Farm women have larger families than city women and less time to study the problem of the pre-school child on a rampage. The solution of it is not so easy when there are dishes and dairy utensils to scrub and meals to get for outdoor men with carnivorous appetites. On top of that their average day is beset with medicine and extract peddlers, government inspectors, town committeemen, and sundry other delegations, who always stop at the house right in the middle of good haying weather, when they must know that the boss is

out afield. Hence the brunt of the "office" work in the farm house is taken by the women folks. It is no wonder farm women look forward to something snappier than the weekly ladies' aid society to untangle jagged nerves. In picnic and vacation time they usually "second the motion" to get into motion. And no trailers for them either! Genuine farm relief to the harassed females is to get relief from culinary chores.

OVER in the other gender we find the males troubled with sunburn blisters, prickly heat, and barley beards,

mosquito bites and triple A quotas. If that doesn't set them longing for the rest-cure, then the cows rush into the corn field, some newly invented weed takes root on the homestead, or trespassers sneak up on the melon patch. Or maybe the hired man leaves his shoes on the dresser and insists on using the family coach to hunt skunks in. So the boss man of the farm is ready anon to join his wife gladly in taking the perambulator degree in the migrating lodge of Marco Polo.

And then the kidlets have their innings. Despite warm but suspicious invitations from off-side relations in adjacent suburbs, they are not any "anxiouser" to accept than their folks are to permit. That's no kind of a free spell whatever. Besides it has drawbacks in the shape of comebacks. For every kid spending a week in a cousin's abode you will have five cousins and a dog becoming much at home in strawberry time. No indeed, you can't exchange vacations like you do labor on the farm. In somewhat illogical sequence, as is my wont, I have determined clearly that you can neither take a vacation at home nor take in somebody else's vacation comfortably. But you can always adhere to obstinate custom and go for a picnic. The cost is nil.

Picnics are really not classed as Simon-pure relaxation, and never were as far as I can find out. They are just some place to go and while away awhile, intermixed with mushy eats and such gurgling refreshments as you can smuggle along and imbibe with your brother-in-law behind the bushes. As breaks in the monotony of farm life, real or imaginary, picnics are a boon to some of us and a bore to most of us. But like high school oratory, farm bureau band concerts, and amateur poker games, they are rated as harmless features of communal life, always to be endured in silent semi-contentment. They afford no opportunity for critical analysis and are in no sense a professional offering.

PICNIC conditions have altered since my boyhood. First, the old places are gone. The spot where I ate my first cindered wiener a la campfire is now a reeking gas station, and no respectable, able-bodied, daddy-long-legs can be found on the cement pavement where we used to spread our messy meals on mossy banks.

Few but the gas-thrifty frequent their own home picnic grounds these days. Going a hundred miles to a summer gathering place is not unusual for a day's farm outing, whereas we were tickled enough as kids to pack up and follow the cows along the creek bed.

(*Turn to page* 47)

Microbes as Factors In Soil Fertility

By S. C. Vandecaveye

Washington Agricultural Experiment Station, Pullman, Washington

ALTHOUGH the soil is generally thought of as a medium for plant growth, the fact remains that it is much more than that. It is a complex natural body characterized by specific inherent physical and chemical properties acquired largely through the influence of climate and vegetation. It is also a body which is inhabited by an invisible micropopulation more diverse in character and participating in a greater variety of activities than the visible inhabitants of the earth. The peculiar characteristics which differentiate the soil from weathered rocks or geological sediments and make it the particular medium for plant growth, we find it to be, were initiated by and have in a marked degree resulted from the activity of the soil microbes.

The apt saying that the importance of things infinitely small is infinitely great may well be applied to the soil microflora, whose functions and activities still hold a multitude of mysteries and offer an exceedingly fruitful field for research despite the fact that past investigations and particularly those in recent years have disclosed much of scientific and practical value. Since the soil in an agricultural sense is the medium for crop growth, and the character of this medium is so greatly influenced by the soil microbes by virtue of their nature and multitudinous functions, soil fertility or that property of the soil which makes it productive can be expected to be affected in a similar manner.

The great majority of the species belonging to the soil micropopulation depends upon plant and animal residues as sources of food and energy. One of their chief functions, therefore, is the transformation of organic matter resulting in humus production, the liberation of plant nutrients, and innumerable chemical reactions. The soil micropopulation belongs in uneven proportions to the animal and plant kingdoms, the latter including the large majority in both kinds and numbers.

Forms of Fungi

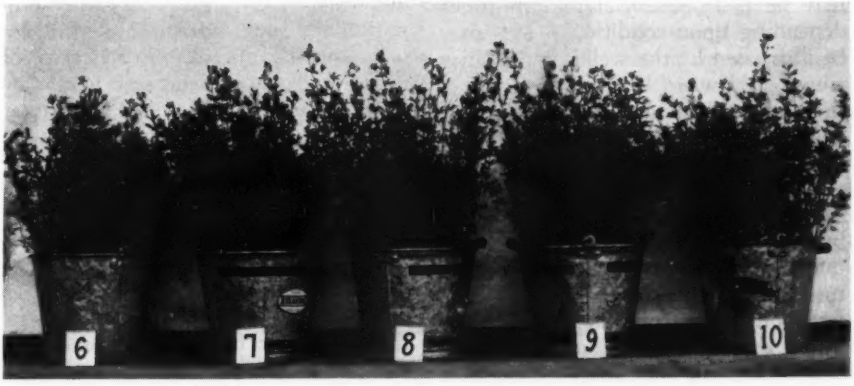
The microscopic plant kingdom in the soil, or the soil microflora in other words, is represented by the algae, the fungi, and the bacteria named in the order of their increasing importance of numbers and activities. While the algae populate the soil in considerable numbers and are known to exercise certain important functions, too many of their activities are yet unknown to generalize concerning the role they may play in soil processes. The major known microbial functions of importance in soil fertility are thus confined to the fungi and the bacteria.

The fungi may be subdivided into three groups: yeasts and yeast-like fungi, molds and other true fungi, and actinomyces. The importance of yeasts and yeast-like fungi in soil processes is not well known, but that of the other two groups is better understood and worthy of consideration.

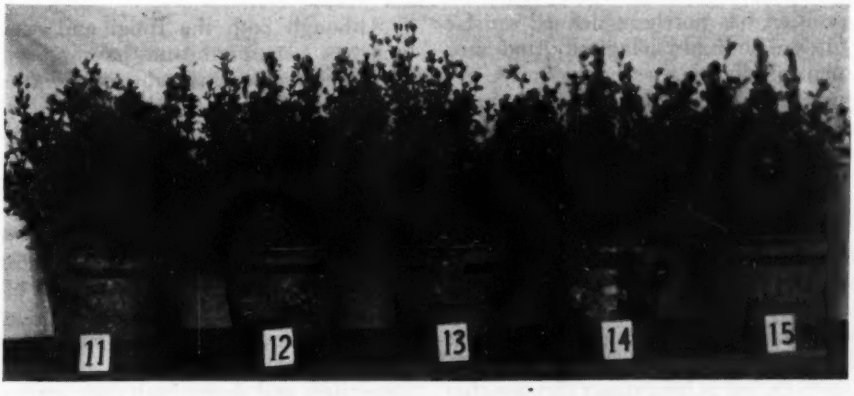
Fungi exist both in the form of vegetative mycelium and as reproductive

Fig. 1—Second cutting of a 3-year-old stand of alfalfa in the half bloom stage. (Bacteriophage infected soil).

1, 2, 3, 4, and 5—no fertilizer treatment.



6, 7, 8, 9, and 10—ammonium nitrate at the rate of 80 lb. of N per acre.



11, 12, 13, 14, and 15—ammonium nitrate, superphosphate, and sulfate of potash at the rate of 80 lb. of N, 90 lb. of P_2O_5, and 75 lb. of K_2O per acre.

spores. Because of this dual existence their exact numbers are difficult to ascertain, but their relative abundance can be estimated by the culture plate method using suitable nutrient media. The numbers thus obtained may range from 10,000 to 1,000,000 per gram (.035 oz.) of soil on the dry basis depending upon the soil type and the food supply. Rapid decomposition of complex organic substances and assimilation of soluble nitrogen and mineral compounds are two important functions of fungi. They assimilate as much as 30 to 50 per cent of the carbon and relatively large amounts of soluble nitrogen for the synthesis of their cell substance, and because of this assimilation the role of fungi in the growth of higher plants may be both beneficial and injurious depending upon conditions. This may be illustrated by the well-known "fairy rings" in lawns. When the spores of the fungi associated with the fairy rings germinate in the soil, small circular areas are formed, and the grass growth which is first stimulated by an increased supply of available nitrogen liberated by fungus activity is depressed subsequently by insufficient food and moisture in the area of dense mycelium. Later on the grass develops luxuriantly again, when the mycelium decomposes and releases an abundance of available nitrogen.

The actinomyces or ray fungi are a group of organisms whose systematic position has not been defined satisfactorily. Both physiologically and morphologically the actinomyces are differentiated from bacteria and fungi. They are more sensitive to acids than the bacteria and particularly the fungi. Unlike the bacteria which form various gases from carbohydrates, the actinomyces produce no other gases than CO_2 and behave like fungi in this respect.

Morphologically, actinomyces colonies are hardly distinguishable from bacterial colonies in the early stages of growth, but at later stages they are characterized by the formation of a unicellular mycelium composed of hyphae showing true branching like those of the fungi. Actinomyces are thus found to partake of the nature of both bacteria and fungi and are tentatively classed as intermediate forms. They are universally distributed and in certain soils represent from 40 to 60 per cent of the colonies growing on common agar plates. Their numbers range from 100,000 to 20,000,000 per gram of soil. All species take an active part in the decomposition of organic matter both nitrogenous and non-nitrogenous.

The actinomyces as a group appear to be better able to attack the more resistant organic substances than are the bacteria or fungi, and in contrast to the fungi they produce relatively small quantities of mycelium and utilize proportionally small amounts of nitrogen. Consequently, the decomposition of highly carbonaceous organic matter by actinomyces is accompanied by a lesser depressing effect upon ammonia accumulation and plant growth than decomposition of these substances by bacteria or fungi. Actinomyces are among the few soil microbes capable of attacking humus substances, and therefore they play an important role in humus decomposition as well as in humus formation. Another factor of economic importance is that certain important plant diseases are produced by actinomyces.

Forms of Bacteria

Although both the fungi and actinomyces play prominent roles in soil processes, the dominant microbial forms consist of bacteria. On the basis of carbon and energy requirements, the soil bacteria may be divided into two groups; the autotrophic bacteria, and the heterotrophic bacteria. The autotrophic bacteria are those which can thrive on purely inorganic substances for their energy and on the carbon dioxide in the air for their carbon. The heterotrophic bacteria require substances which have been built up by other organisms and derive both their energy and carbon from these substances.

The autotrophic bacteria being the smaller of the two groups in numbers are concerned with oxidation processes and include forms which are indispensable in certain soil processes. Specific forms of autotrophic bacteria oxidize methane, hydrogen, nitrogen, iron, and sulfur compounds. Those which oxidize nitrogen and sulfur are extremely important in soil fertility, since plants absorb most of their nitrogen and sulfur in the nitrate and sulfate forms.

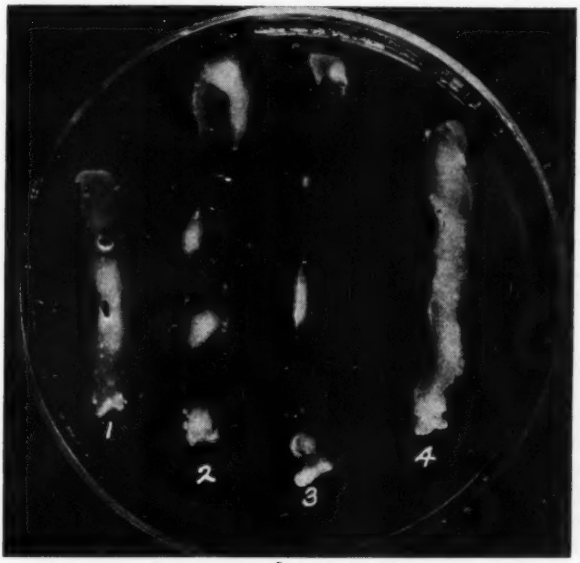


Fig. 2—Lysis of Rh. meliloti (Alfalfa nodule bacteria) by bacteriophage infected alfalfa nodules and by filtrate of bacteriophage isolated from soil in alfalfa fields. (1) Streak of Rh. meliloti with pieces of healthy alfalfa nodules. (2) Streak with pieces of bacteriophage infected nodules. (3) Streak impregnated with a loopful of homologous bacteriophage isolated from alfalfa soil. (4) Untreated "control" streak.

The heterotrophic bacteria constituting the majority of the soil micropopulation number from 1,000,000 to 50,000,000 per gram of soil as determined by agar plate counts. They logically fall in two groups on the basis of nitrogen utilization. The first group is composed of bacteria capable of atmospheric nitrogen fixation in the presence of carbohydrates as a source of energy and is represented by the symbiotic and nonsymbiotic nitrogen fixers. The other group consists of bacteria which require organic or inorganic soil nitrogen for their metabolism.

The symbiotic nitrogen-fixing bacteria are represented by the genus Rhizobium, commonly known as legume nodule bacteria. Their activity which can be controlled to a certain degree plays an important role not only in plant growth but also in soil fertility and nitrogen economy. By careful selection of suitable strains the ability of various species of Rhizobium to form nodules and benefit the host plant has been built up to such a high degree of efficiency that legumes produced on nitrogen-deficient soils properly inoculated with homologous cultures of these organisms may utilize as much as 350 pounds of atmospheric nitrogen per acre annually.

Unfortunately the story of the economic importance of Rhizobium is incomplete without mention of the susceptibility of this organism to the attack of a bacteriophage which causes lysis or dissolution of the bacterial cells in the nodules and consequent reduction or even arrest of symbiotic nitrogen fixation. This lytic principle or bacteriophage described and isolated from nodules of various legumes by several investigators in recent years was isolated from the soil for the first time in alfalfa fields in this country by the writer and his collaborators 3 years ago.

The activity of this lytic principle is illustrated in figure 2, which presents four streaks of an alfalfa Rhizobium culture on nutrient agar. Streak 4 shows the normal, healthy growth of alfalfa nodule bacteria on agar plates. Streak 1 to which three pieces of healthy alfalfa

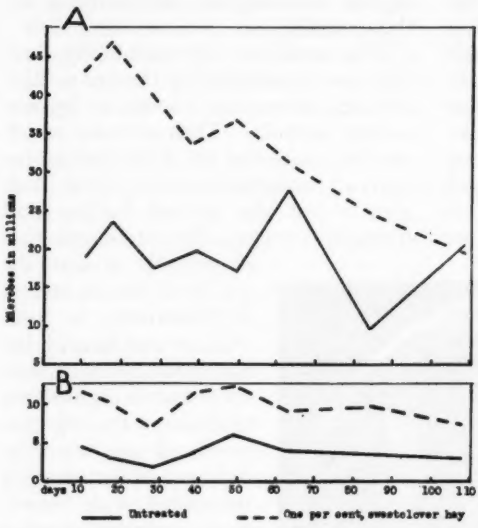


Fig. 3—Total numbers of bacteria, fungi, and actinomycees per gram of soil; A, in Palouse silt loam; B, in Melbourne silt loam.

nodules were added shows normal growth also, but streak 2 to which three pieces of bacteriophage infected nodules were added exhibits definite areas of lysis or dissolution of the cell growth around each piece. Streak 3 which was impregnated with one loopful of homologous bacteriophage is nearly completely lysed.

Greatly reduced yields of alfalfa hay in certain 3- and 4-year-old alfalfa fields in widely separated areas have been found to be associated with bacteriophage in the soil. Soil obtained from a bacteriophage-infected alfalfa field and placed in 15 twelve-quart pails protected inside by two coats of Gilacoat asphaltite produced normal growth of alfalfa for 2 years outdoors, but the yield of the first cutting the third year was much below normal. The 15 pails were then divided into three lots, and one lot received no treatment, the second received ammonium nitrate at the rate of 80 pounds of N per acre, and the third received superphosphate and sulphate of potash at the rate of 90 pounds of P_2O_5 and 75 pounds of K_2O per acre in addition to the nitrogen.

The effect of these treatments on plant growth is strikingly illustrated in figure 1. The treatments were repeated for the third cutting of alfalfa and similar results obtained. The average yields of the two cuttings of alfalfa on the soil receiving the complete fertilizer were not significantly greater than those on the soil receiving nitrogen alone, but those on the untreated soil were only 37 per cent of the yields of the nitrogen-treated pails. These results indicate that a lack of available nitrogen was responsible for the poor growth of alfalfa on the untreated soil, and it appears that the bacteriophage present in the soil had caused a severe reduction if not a complete arrest of symbiotic nitrogen fixation. Thus it seems that adequate control of the activity of this economically important genus, Rhizobium, will not only require the selection of virulent strains of legume nodule bacteria but of virulent strains that are bacteriophage resistant.

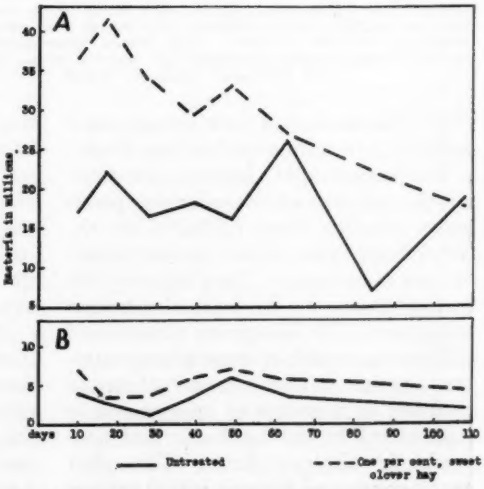


Fig. 4—Number of bacteria per gram of soil; A, in Palouse silt loam; B, in Melbourne silt loam.

Non-symbiotic nitrogen fixation in cultivated soil is thought to be accomplished largely by the Azotobacter species. These organisms do not occur generally in acid soils, and although they can utilize a variety of organic compounds as sources of energy and are capable of fixing large amounts of atmospheric nitrogen under suitable conditions, their activity in cultivated fields is not yet under man's control. Various estimates of the nitrogen fixed by Azotobacter in farmed soils range from 10 to 40 pounds per acre annually.

The heterotrophic bacteria which require combined nitrogen for their metabolism comprise the majority of the bacterial colonies developing on the common agar plate. They take part in numerous soil processes, particularly those pertaining to organic matter transformation. It is in this connection that the bacteria together with the fungi and actinomyces play their most important role in soil development and soil fertility.

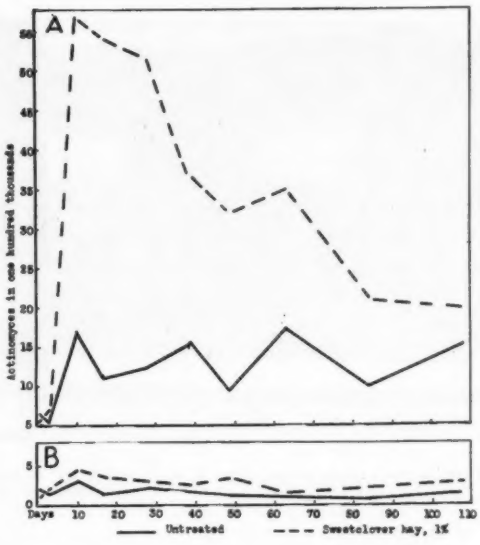


Fig. 6—Number of actinomyces per gram of soil; A, in Palouse silt loam; B, in Melbourne silt loam.

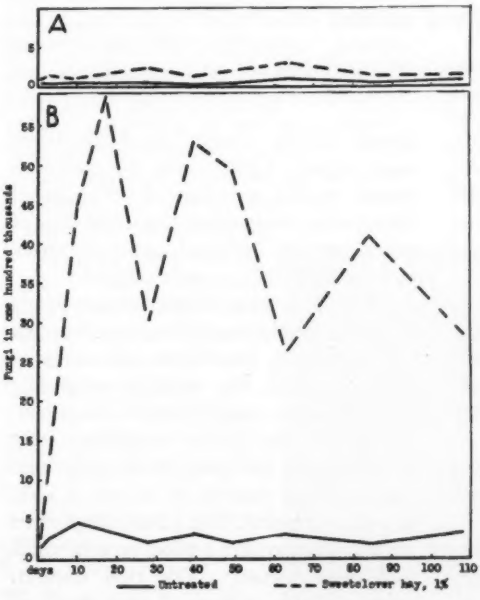
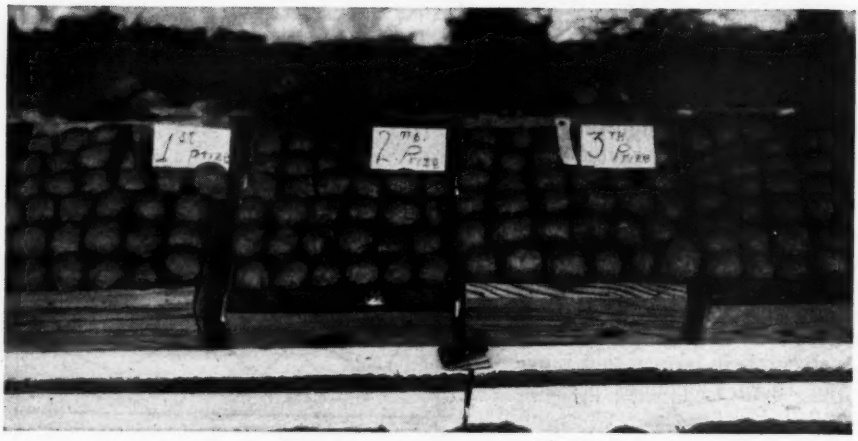


Fig. 5—Number of fungi per gram of soil; A, in Palouse silt loam; B, in Melbourne silt loam.

The addition of plant residues to the soil is followed by an immediate stimulation in the activity of the bacteria, fungi, and actinomyces as manifested by rapid multiplication in numbers and profuse CO_2 production. The rate and degree of this stimulated activity is determined by the nature and composition rather than by the amount of plant residue added. This is well illustrated by the data in table 1 taken from the results of a study of the effect of manure on the microbial activity in virgin peat carried out by the writer a few years ago.

Although these data show that the peat and the manure do not vary much in carbon and nitrogen content, they differ greatly in other chemical properties and in their general nature. The total number of microbes in the manure was not only about fivefold that of the peat, but the composi-

(*Turn to page* 43)



Prize winners green wraps, Prize 1, 2, 3, and 4, left to right, at the 1938 tomato festival, Monticello, Arkansas.

Growing Good Tomatoes In Arkansas

By Clifford Alston

County Agent, Drew County, Arkansas

THE value of a 4-8-6 fertilizer in producing quality tomatoes in Arkansas was demonstrated at the 1938 Tomato Festival at Monticello, Arkansas, when 13 of the 18 winners used from 600 to 800 pounds per acre.

These growers used an average of 692 pounds of 4-8-6 fertilizer per acre. Six growers used 600 pounds per acre, two 700 pounds per acre, and five used 800 pounds per acre. Two other winners used a 3-12-12 mix at the rate of 600 pounds per acre, with the remaining three using a home mix of approximately the same analysis as a 4-8-6.

Good fertilization methods have been one of the deciding factors in placing the area as the largest tomato-producing territory in Arkansas and one of the largest in the South. In 1938, there were about 1,500 acres of tomatoes grown within a radius of 15 miles of Monticello, with more than 400 cars of green wraps shipped, and approximately 3,000,000 pounds canned.

About one-third of the farmers apply all of the fertilizer at planting time with the remaining two-thirds side-dressing with some of the mixture originally used, or some other kind of fertilizer.

Two of the above producers side-dressed with 100 pounds of kainit and one used 100 pounds of nitrate of soda as a side-dressing. One producer planted his tomatoes where a good crop of vetch had been turned. The two winners using 3-12-12 applied all of it at planting time.

Rate of Application	Time of Application
600 lb.	All at planting
800 "	400 lb. at planting, 400 lb. side-dressed
800 "	400 " " " , two 200 lb. applied
600 "	All at planting
800 "	400 lb. at planting with 400 lb. side-dressed
600 "	All at planting
700 "	All " "
700 "	All " "
600 "	All " "
600 "	All " "
800 "	500 lb. at planting, 300 lb. side-dressed
800 "	500 " " " , 300 lb. side-dressed
600 "	All at planting

The table shown above gives the time of application for the 13 winners using 4-8-6.

Tomatoes are most successfully produced on a warm, fertile, well-drained loam soil. For highest yields and quality tomatoes, it is important to use soils which have a high water-holding capacity. Tomatoes should be planted on a well-prepared seed bed, and on land that is free from diseases.

Much care and thought are given in selecting the best quality of seed possible. The quality, trueness to variety, and strain of seed have such a marked influence over the quality and production of tomatoes that no effort should be spared in selection of seed. Approximately two ounces of seed will produce enough plants for one acre.

The seed are sown in hot beds in February. In March they are transplanted to cold frames by planting them about 3 to 4 inches apart. They remain in the cold frames until they are about 8 inches high at which time they are transplanted to the fields with a small amount of soil still attached to the roots.

All plants used in the county are grown by a few farmers who specialize in growing plants. A few farmers produce only enough for home use and do not offer any for sale. Very few plants are sold outside the county. Gulf State Market and Marglobe are the two most popular varieties grown. Marglobe is gaining in popularity and the majority of farmers are using it at the present time.

Proper cultivation is another important factor. Tomatoes are cultivated deep soon after setting with subsequent cultivation being shallow. The tomatoes are staked and pruned before production starts. This has been found to increase the quality and size of the tomatoes harvested.

Another factor in the success of the enterprise is maintenance of good prices by the Drew County Cooperative Truck Growers' Association, which is affiliated with the South Arkansas Truck Growers' Association. Last year the Associa-

(*Turn to page* 42)

Tomato plants being grown in flats in Arkansas' tomato center.

Toward Cutting Marketing Costs

By C. B. Sherman

U. S. Department of Agriculture, Washington, D. C.

OUR FRESH fruit and vegetable crop, sold as such, is worth about a billion dollars at the farms. It costs about one-and-a-half billion dollars to market that crop. With these crops growing larger all the time, what do you suppose a marketing cost like that is going to do to demand and consumption? And to the farmers, who are getting only about 40 cents out of each consumer dollar as things are now?

Evidently there has got to be a determined drive on those costs. There are several fronts on which an attack can be made. All are under consideration, and some are feeling the results.

Farmers have been hearing for years about reducing the costs of production, or about getting better results for the same expense, and they and their leaders are working diligently at these problems. But what does it profit a farmer to reduce those costs, if the gains immediately disappear in swollen marketing expenses?

Just where are these marketing costs the largest? Analyses show that more than one-half of the huge cost comes after the products reach the large cities. Obviously then, these are the spots that most need attention. They are about the hardest places to begin, because they are so complex and represent so many interests. But that fact is no longer deterring those who are out to get reductions in these costs for the sake of the farmers, the dealers, and the consumers.

Studies and analyses in 40 cities, including 101 markets, show that waste and inefficiency are prevalent in most of the city markets, and that the nature of the troubles is common to most of them. So instead of devoting too much attention to the habits of the middlemen, it seems best to devote some attention to the equipment with which most of them are compelled to work.

Most of these 101 markets are too old to do their work well or to allow those who use them to act efficiently. We have our historic structures like Faneuil Hall in Boston, now 200 years old, and the Old French Market in New Orleans, now 150 years old. Others are younger but still full of years.

Inadequate Facilities

This means that the layout and equipment are often badly out of date. Stores in the markets are usually dark, crowded, and narrow, and frequently have only one entrance. The streets and driveways are narrow and congested. Sidewalks are piled with produce, and sometimes men must walk on it to do their work. Curbings and platforms are built neither for wagons nor trucks. There are no railroad sidings or they are badly placed. Storage facilities are inadequate. Trucks coming to load or unload are delayed for hours and sometimes have to unload so far from the stores that the produce must be carried in by hand or hand trucks.

Conditions like these mean increased labor, waste of time, high operating costs, inadequate display and merchandising, unnecessary handling, needless exposure, large losses from spoilage or deterioration that will increase spoilage later in the retail store, unsanitary conditions. These conditions make it practically impossible to attain efficiency in marketing perishable products.

In New York City the cartage expense of hauling produce from the inbound receiving stations through intermediate markets and finally to retailers' stores was estimated in 1936 to approximate 16 million dollars a year. The delays, spoilage, exposure, and inconvenience brought by inability to unload cars directly into markets often encourage the development of rackets, which make unnecessarily high charges for services rendered or levy charges for services that are not performed at all.

Long unregulated selling and working hours, lack of information on supplies, and unethical practices are among other serious problems common to most of our markets. Long selling hours increase the cost of doing business or force dealers and their employees to work excessively long and inconvenient hours, so that sleep is snatched whenever and wherever possible. They also lead to greater price fluctuations throughout the selling period.

Sometimes an ill-advised effort to remedy a situation has made it worse. A second market has been opened that could be used by only one railroad or that was poorly planned or located. This has frequently meant that each dealer had to go to two places to fill his demands, with consequent loss of time, delays, and crosshauls. The produce is handled too much, is too long in the truck, and is just that much more subject to deterioration. When there are more than two large markets, the intensity of the problems is often multiplied by just that number.

Reorganization Needed

When supplies are scattered, price-making is difficult, and it is hard to enforce necessary regulations that would curb racketeering and other unethical practices. Furthermore, the very existence of these separate markets produces a situation in which, because of vested interest and inter-market strife, it is difficult to effect the thorough market reorganization that is needed.

Produce often has to be carried long distances by hand, head, or hand truck because of congested market conditions.

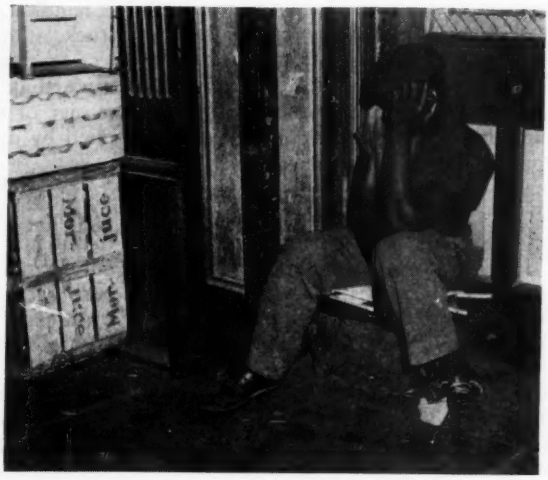
But several cities are now deep in this matter of reorganization. Certain of the leaders and groups are determined to avoid the pitfalls of the past. They are basing their plans on the results of that study of 40 cities plus a close study of conditions within their own trade areas.

These cities are seeing to it that no one agency or group goes ahead without due consideration of the other groups. They are asking for cooperation and are getting it. Growers are being given the same chance to take part as dealers and consumers, and growers are coming forward to do their share and to keep in step with developments.

Cities that are now making records worth watching are Philadelphia, Kansas City, and Atlanta. Kansas City is about to move its market to a new location that has been approved by totally disinterested parties of wide experience. There the market will find new layout and buildings. Atlanta has now found, bought, and paid for a location that is satisfactory to all the groups involved. It is at a junction of three railroads and is convenient to highways that come from every direction. Plans for the new market outfit are now being drawn up with the advice of people who have specialized in problems of this type.

Philadelphia has done a particularly good job in getting diversified groups together. Improvement plans have been worked out that would save from 1 to 2 million dollars each year in cost of distribution in that city. These plans have been discussed with representatives of growers, the trade, the railroads, the consumers, and other groups. Newspapers and radio have entered the discussion. Growers have established county committees, State committees, and a regional committee to insist on improvements—for Philadelphia draws produce from several States. Dealers who handle three-fourths of the produce marketed in Philadelphia have now agreed that they want action and the consumers are interested.

Finally a joint committee has been formed, composed of 3 growers, 3 members of the trade, and 2 consumers. This committee is to coordinate the activities of the groups and to help to concentrate on the selection of approved plans and the procedures to be followed in putting the plan into operation. So the end of the discussion period appears to be in sight.



Because of long unregulated hours the laborers snatch what sleep they can whenever and wherever possible.

Then an agency must be established to work in the interest of all the groups in actually promoting, building, leasing, and managing the necessary facilities, for this is highly specialized work.

That every large community wanting it may have disinterested guidance based on study and experience in many other large communities, the U. S. Department of Agriculture is now supplying an adviser on request, when it is convinced that the locality is ready for effective debate and action. Continued participation in the procedure depends

(*Turn to page* 40)

Ex-students Extend Ontario's Experiments

By Dr. G. P. McRostie

Ontario Agricultural College, Guelph, Ontario, Canada

SIXTY years ago an outstanding agriculturist was seized by a new idea. Investigational endeavors of many kinds were being carried to a successful conclusion at the Ontario Agricultural College and Experiment Station, but the benefits of such work were not being as widely felt as they should have been. To meet this situation the new idea, which took the form of the Ontario Agricultural and Experimental Union, was developed. This organization had as its objective the promotion of intercourse between the College and its ex-students, with the object of extending the information secured at the College to a much wider field of agriculture.

Since its inception the Experimental Union has been continuously concerned with the testing of farm crops of different kinds, and this phase of work has probably been the outstanding theme throughout the 60 years during which the organization has functioned. However, from time to time many other phases of agriculture have received consideration. These have included vegetable gardening, dairying, livestock, apiculture, weed eradication, poultry raising, forestry, seed inoculation, economics, etc.

Early in the history of the co-operative testing of crops it was realized that varieties would likely react quite differently to the varying climatic and soil conditions existing in different parts of the province of Ontario. Such a variation was very definitely proved to exist.

Not many years after the organization of the Experimental Union, the membership was extended to include farmers and others interested in the extension of agricultural information. The payment of a small annual membership fee, which for years has been 50¢, and an expressed interest in the co-operative testing of crops constitute the basis for membership in the Union.

New Varieties Introduced

In the many years during which Dr. C. A. Zavitz, formerly head of the Field Husbandry Department and secretary of the Experimental Union, was in charge of affairs, thousands of growers over the province of Ontario, and indeed scattered very much wider through all parts of Canada and in foreign countries, annually received samples of the newer kinds of crops. These were planted on their own farms in comparison with the crops being regularly grown, and a careful report of their behavior was returned to the secretary after the growing season had been completed. Through the agency of these tests the suitability of varieties for certain areas was established, and newer varieties were much more widely and quickly introduced than they could otherwise have been.

At the present time the co-operative testing has been extended to include a well-defined plan of supervised tests of a fairly large number of the more promising, newer varieties. These tests are

(*Turn to page* 46)

Cows and Cotton

By Ben Hilbun

Editor, Mississippi State College, State College, Mississippi

ABOUT 60 years ago Col. W. B. Montgomery startled the people of Oktibbeha County, Mississippi, by importing a small herd of cattle from the Isle of Jersey. He further gave rise to tongue-wagging by predicting that dairying would eventually displace cotton raising in the rolling hill section of Northeast Mississippi.

Many thought the colonel was suffering from a heat stroke or was the victim of some strange delusion that had sidetracked reason. The most ignorant knew cotton was the imperial ruler, and not even the most radical had ever dared suggest that the king's power was in danger of declining.

Colonel Montgomery unloaded his jerseys and quartered them in a nice brick barn that was built for blooded horses. To lovers of fine horses, this act was nothing short of a travesty, and to others it was additional evidence that the Colonel "had gone nuts about devilish dairy cows."

This seer of a new day visualized a sweeping change. Instead of cotton fields tied together by woodland strips, he saw pastures forming a waving carpet dotted with grazing cattle. But he reasoned that pastures did not consist of acres of land enclosed by two strands of wire. They had to be built and cared for.

Accordingly, Colonel Montgomery took up a second hobby—good pastures. His farm was several miles from town. He arose about 3 o'clock in the morning, hitched two wiry ponies to his buggy, and hit out for the farm. His pockets were usually full of grass and clover seed when he left his home, "The Cedars," and as he drove along he'd scatter them sparingly on good earth.

The debt-free Cooperative Creamery located at Starkville. Organized in 1912 with 14 patrons, it now has 400 regular patrons.

With his two obsessions, jersey cows and pasture plants, he laid the foundation for the Capitol of Southern dairying. His herd was headed by the first American champion bull Mississippi ever produced, Champion of America (1567), Son of Pansey (1019).

Curiosity of the populace gradually gave way to interest. Other farmers began adding a few cows, thus broadening

the foundation of a new source of wealth. More dairy products, chiefly butter, than could be used locally finally resulted in diarymen seeking markets elsewhere. Hand-moulded butter was shipped to nearby towns, but lack of uniformity of quality and the discouraging cost of handling it on an individual basis created a formidable barrier in the path of rapid expansion.

Advent of the boll-weevil and its subsequent destructiveness produced revolutionary tendencies among land-owners. Farmers, with their backs to the wall, were willing to try anything to stave off the loss of home and farm. Dairying, an unpopular but partially proven venture, seemed to be the most logical means of escape from the real dilemma of ruin or revolution in farming.

Organized a Creamery

These farmers, however, realized that the individualism of the cotton planter could not be transferred to dairying. They must work together in order to market their product, and in 1912 they organized a cooperative creamery, the first successful one of its kind in Mississippi. There were only 14 signed patrons, and that year $4,000 constituted the cash payments for cream.

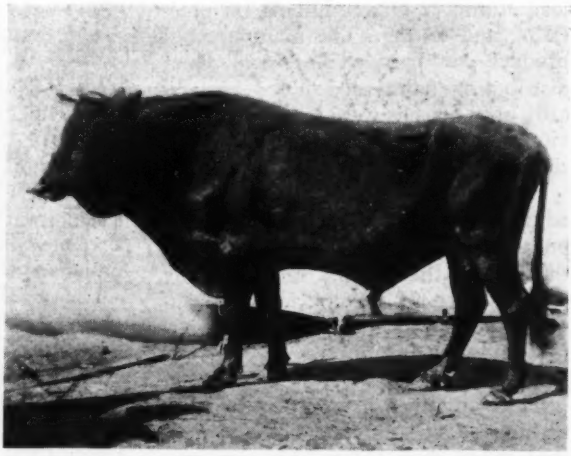
The creamery, housed in the dairy building at State College (then A. & M. College), was launched under the name of "A. & M. Cooperative Creamery," a name that is familiar in the South today. It began putting out "A & M. Butter" and now sells the same brand from New York to New Orleans.

More people shifted from side-line to main-line dairying, and the creamery began to grow. From 14 patrons who owned small herds, 400 with larger and better herds are now delivering sweet cream to the plant. In the early 20's, the plant was taxed to handle the cream, especially during the grazing season. Talk of expansion began.

In the spring of 1923 a native of Oktibbeha County, the late Wallace Maxwell, who was a salesman for Borden Company, suggested the possibility of a condensery. Maxwell knew how dairying had developed in his home county, and he also knew that it could be expanded tremendously. His suggestion was a vague clue to a new industry, but it was taken up and vigorously pursued for 2 years.

The first major job was to convince homefolks that they could supply enough milk to a condensery without destroying their first love, the Cooperative Creamery. Creamery officials joined in the movement to secure the plant, saying that it would stimulate production which would enable the creamery to further expand.

Talk was supplemented with facts. A survey of dairy cattle was conducted, and to the astonishment of the most optimistic, the "cow count" revealed 18,000 head of jerseys in an 18-mile radius. The Borden Company was in-



This bull wouldn't pass muster today, but he was "tops" 50 years ago when hoop skirts and bustles were in vogue.

This fine herd of Jersey cows keeps fit on good pasture.

terested, but assurance of production alone didn't suffice. They had to be convinced that the bitter weed curse was not an insurmountable barrier. They also had to know whether milk produced in the deep South would keep after being canned. Furthermore, they had never canned milk as rich in butter fat as that produced in the Oktibbeha County area.

Citizens collected and shipped a carload of milk to Dixon, Illinois, for processing and testing. The manufactured produce was parceled out to all chief distribution points and tested periodically until officials were thoroughly convinced that milk produced in Mississippi would not deteriorate in the can.

Final decision, announced by a special edition of the weekly paper, was to build a condensing plant at Starkville, the first in the South. Still, company officials were a bit skeptical about getting enough milk the first years to warrant full-time operations. The answer was soon given.

Throwing open its doors in the early spring of 1926, the plant had not operated many days before this sign was hung out: "No more patrons accepted until the plant is enlarged." Enlarged it was, and during the time milk was flowing into the plant the Cooperative Creamery was growing by leaps and bounds. In fact, it grew so rapidly that in 5 years' time it left its outmoded old quarters to occupy a brand new $100,000 building that today doesn't have one penny debt against it.

A Profitable Enterprise

The Borden plant, since opening for business in 1926, has purchased 324,571,618 pounds of milk from local dairymen, and has paid them $5,965,558.59 for the product. The plant has also paid out $498,300.00 for labor. The Cooperative Creamery, for the same period, purchased $3,294,405.00 worth of cream and turned loose $288,000.00 for labor in the operation of the plant.

The two plants for the 12-year period, which included the worst depression the country has ever experienced, disbursed $10,046,263.59 to dairymen and plant employees. The average annual cash payment amounted to $837,188.63. About 1,800 persons patronize the two

(*Turn to page* 45)

It Costs Little Extra To Fertilize Right

By Herbert L. Garrard

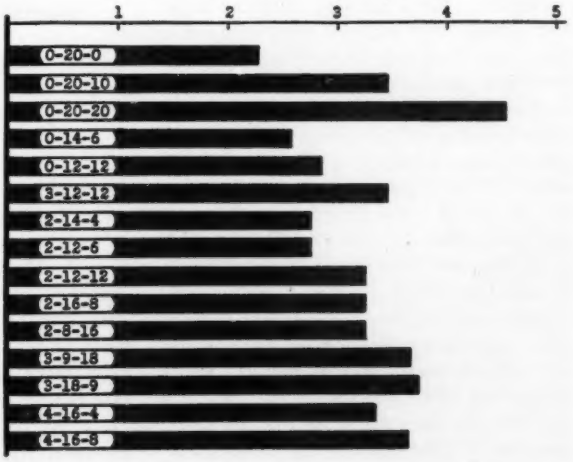
Chicago, Illinois

THE cost "per ton" alone should not determine what grade or analysis of fertilizer to buy. With fertilizers relatively one of the cheapest commodities the farmer buys, it is usually profitable to supply the necessary plant food for a particular crop and rotation even though it means a slight increase in total production costs. Actually the difference in fertilizer costs "per acre" is surprisingly small when considered in terms of crop yields and values.

The cost per hundred pounds for each of several fertilizer grades is shown in the accompanying table. The actual increase in yield of the various crops necessary to pay for 100 pounds of each fertilizer analysis has been calculated, and the results are given in the last four columns of the table. It is obvious that the difference in the cost between any two grades in terms of crop units is relatively unimportant. Further, it should be noted that the costs per acre of 0-12-12, 2-12-6, or 2-14-4 are nearly identical. Also the 2-12-12 and 2-8-16 or 2-16-8 cost exactly the same.

In considering the advisability of using additional potash in the fertilizer analysis, the question can be easily answered by comparing the actual increase in the yields of the various crops necessary to pay for the additional potash. For instance, it would require only 3 bushels of potatoes to pay for the difference in cost of 1,000 pounds of 4-16-4 and 4-16-8. It would cost about the same to use 3-12-12 as it would to use 4-16-4. If it is a question of 2-12-12 or 2-12-6, it would be necessary to increase the corn yield only 1 bushel to pay for the additional potash in the 200 pounds of 2-12-12. About .6 of a bushel of corn will pay for the difference between the cost of 200 pounds of 0-12-12 and 0-14-6.

The relatively insignificant quantities of crops required to pay for 4 additional units of potash in a 250-pound applica-



Fertilizer costs per 100 lb. in terms of bu. or corn, Indiana.

tion of mixed fertilizers may be easily calculated, allowing conservative prices of 50¢ per bushel for corn, 70¢ for wheat, 60¢ for potatoes, 50¢ for barley, and $10.00 per ton for alfalfa hay. On this basis, 4 units of additional potash in a 250-pound application would require only .84 bushel increase in corn, .6 bushel increase in wheat, .7 bushel increase in potatoes, .84 bushel increase in barley, and only 84 pounds per acre increase in the yield of alfalfa hay.

Fertilizer Pays Its Own Way

If nitrogen is needed for wheat, it can be supplied in the form of 250 pounds of 3-12-12 instead of 0-12-12 at a cost of only 1 bushel of wheat per acre. Because of the very small differences in yield required to pay for the differences in costs of the various grades of fertilizers used in the Midwest, it is only possible to measure yield differences by the most accurate methods in actual field trials. In many cases the differences in yields necessary to pay for the differences in costs of the various treatments are so small that they cannot be observed by the eye. For example, the question may be between the use of 300 pounds of 0-20-10 or 0-20-20 on a barley crop which is to be seeded to alfalfa. On checking the yields of the grains, the increase may not have been quite sufficient to pay for the entire fertilizer application. However, it is well recognized that alfalfa responds to rather heavy fertilization since it requires large amounts of phosphates and potash. The legume crops usually have to "eat at the second table" so to speak, and take what may be left following the grain harvest. If the alfalfa is allowed to stand for about 2 years it will usually mean a total of about 6 cuttings of hay. The original application of 300 pounds of 0-20-10 costs approximately $5.20 (equal to 1,047 pounds of alfalfa) and the 0-20-20 costs $6.87 (equal to 1,377 pounds of alfalfa). In six cuttings of hay, only 55 pounds more hay per acre per cutting will pay for the additional potash in the 0-20-20. Such small but profitable differences in yield due to fertilizers usually go unnoticed in an ordinary farming operation. In fact, it is rather difficult to detect such small variations accurately in ordinary field trials.

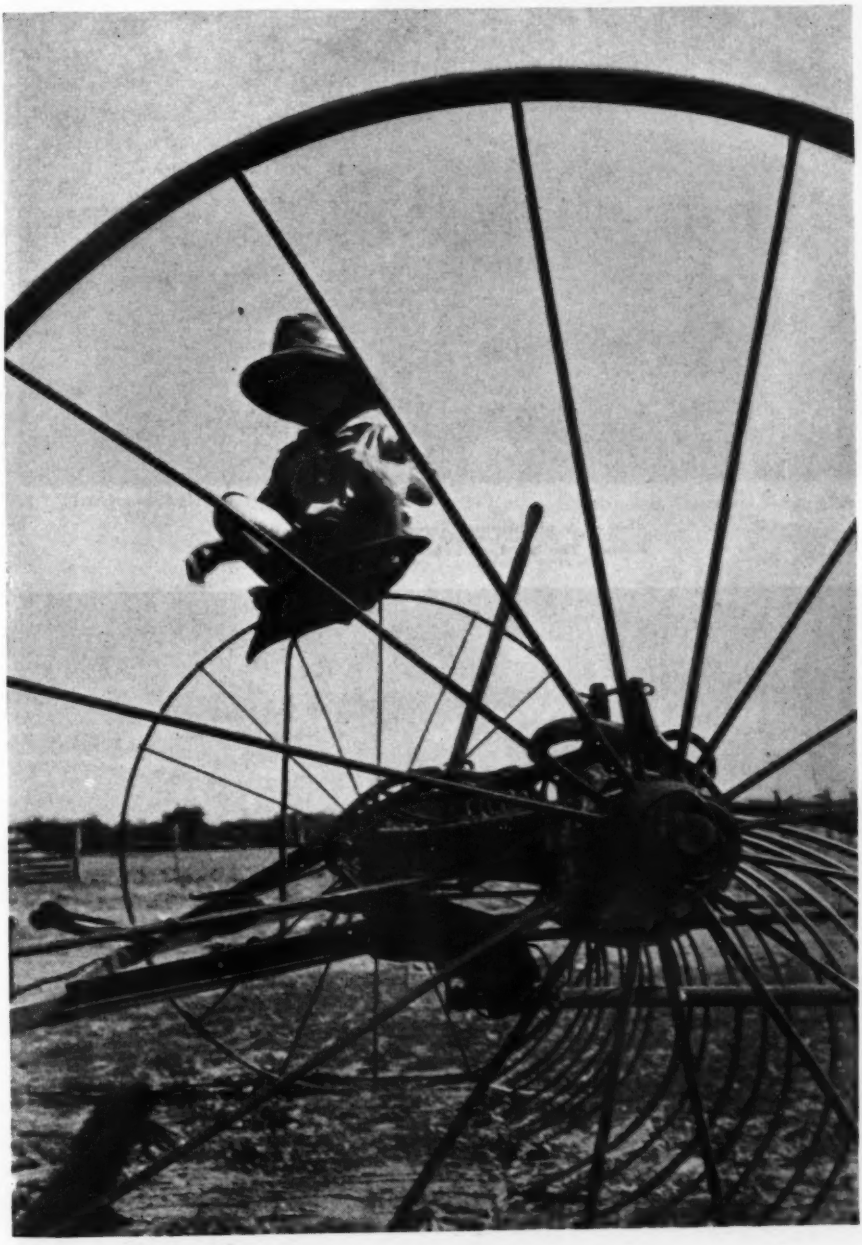
At times too much is expected in the way of visible effects from fertilizers applied for a particular crop. On soils which are already in a medium state of fertility, abnormal differences in growth response should not be expected. In several years' experience in checking and estimating yields in field demonstrations, it is becoming more and more clear that one cannot estimate by observation alone the effects of fertilizers at the higher yield levels. This is especially noticeable when comparing two application rates of the same fertilizer grade, as 200 vs. 300 pounds 3-12-12 on wheat. The extra 100 pounds of 3-12-12 would cost about $1.73, equal to 2.5 bushels of wheat @ 70¢. If the first 200 pounds of 3-12-12 raised the yield to a level of 20 bushels per acre, it may not be possible to judge by the eye whether the extra 100 pounds of fertilizer was profitable or not, because moderate increases above this level are much harder to see.

Maintain High Fertility Level

From a farmer's standpoint, the fertility level of his soil should never become so impoverished or the nutrients so out of balance that a small application of fertilizer will double or treble the yield. When large crop increases occur from small doses of fertilizer, it is usually an indication that the fertility level is extremely low, and that more plant foods should have been added to the soil years earlier. Plant foods should be made available in quantities large enough to take care of the immediate crop needs with enough extra to prevent depreciation in soil productivity and, if possible, to build up a reserve.

(*Turn to page* 41)

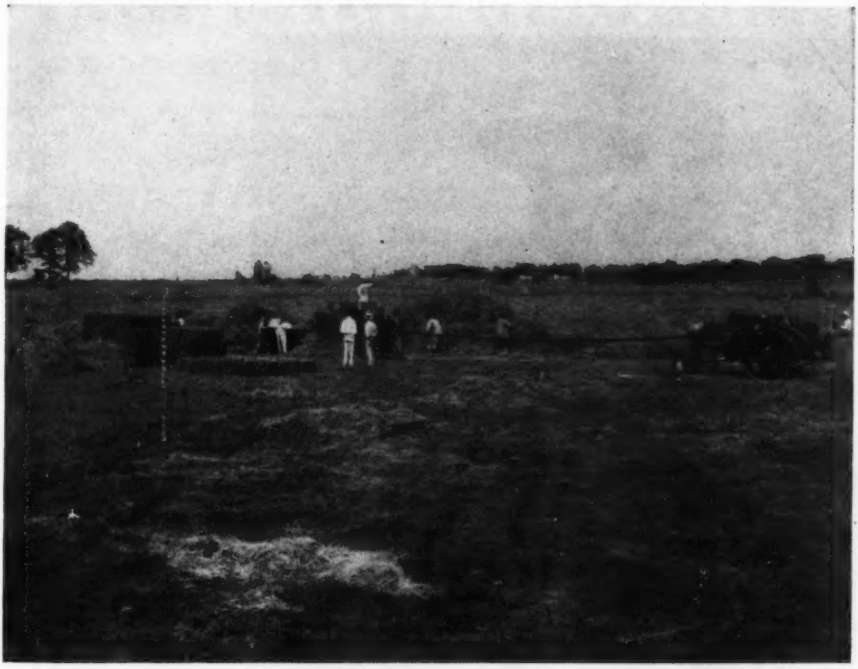
PICTORIAL



STRANDED

Courtesy Ewing Galloway, N.Y., N.Y.

Above: **A picturesque harvest scene in Poland.**
Below: **The last load before the storm breaks.**



Courtesy U.S. Department of Agriculture

Above: **Baling hay in Lowndes County, Mississippi.**
Below: **A Minnesota sky, just after a tornado.**

Golden grain — mid-summer's labor and reward.

The Editors Talk

Midwest Agricultural Problems Studied

The solution of problems underlying more efficient crop production in the Midwest was the outstanding theme of intensive field studies by over 300 members of important agricultural groups during the week of June 12-16. It was the occasion of the joint summer meeting of the Corn Belt and Northeastern Sections of the American Society of Agronomy. The group met at the Ohio State University, Columbus, Ohio, and at the Ohio State Agricultural Experiment Station, Wooster, for conferences and an intensive study of the work being conducted at both places. The two days were climaxed by field trips to branch experiment stations on June 16.

Preceding the Agronomy meetings members and friends of the Plant Food Research Committee, representing the fertilizer industry, spent two days visiting three experiment centers: the Moses Fell Annex Experiment Farm at Bedford, Indiana, the Jennings County Experiment Field, Indiana, and the Miami County Experiment Farm, Troy, Ohio. A sincere vote of thanks is to be accorded the Directors of the Indiana and Ohio Agricultural Experiment Stations and the Chiefs of the respective Departments of Agronomy and their staffs for the trouble taken during these tours in showing the visitors the results of the experimental work that is being conducted by them. One is impressed by the volume of work not only at the chief experiment stations but also at the number of branch experiment stations and outlying experiment fields.

Work pertaining to every phase of research underlying a more efficient crop production was studied and discussed during the 5-day period,—plant breeding, soil biology and fertility, pastures, erosion control and the management of eroded land, extension work, the management of grasslands, production of forage crops, the use of green manures, the effect of specific fertilizers and liming materials, and many other topics were included in the program. Space does not permit a discussion of all the problems studied. Some of the more outstanding themes are noted.

Next to plant breeding and the use of the best varieties of field crops, the determination of the fertility needs of such crops, especially the efficient use of fertilizers and liming materials, was a subject of outstanding importance. For convenience in reporting this topic might be divided into four broad headings: 1. The refinement of plot technique in fertilizer work was one of the topics discussed at a round-table devoted to the subject, the best numbers of plots to use, the size of plots, sampling the yields, in brief, how to obtain the most accurate answer to crop problems from the use of fertility plots. 2. Rapid chemical tests of soils and plant tissues of increasing importance in recent years, were demonstrated, particularly at the Bedford and Jennings County Experiment farms. Heavy applications of fertilizers had been made to certain plots, but the soil tests

showed only normal phosphate and potash contents. The tissue tests, however, amply demonstrated that large reserves of these elements were to be found in the clover residues plowed under earlier in the spring. Thus soil and plant tissue tests are valuable in interpreting the results obtained from plot work. 3. Identification of plant nutrient deficiency symptoms was another important topic. 4. How shall fertilizer be applied? This is a problem of major importance, especially how to successfully apply larger amounts of fertilizer to the corn crop without injury. Advances have been made in solving this problem by applying fertilizers in bands at the side of the seed, but the question is still asked, Will heavier applications of fertilizers applied broadcast for the rotation as a whole be profitable? This question is being studied by the Agricultural Experiment Stations and Plant Food Research Committee.

Successful grassland management is another question of increasing importance. Interesting experimental work was inspected on the tour at Wooster, the Miami County Experiment Farm, and other centers, which visits were followed by a very successful grassland conference at Wooster where some 16 States were represented. A problem facing the Soil Conservation groups is the question of eroded land, how and what crops can be grown on such land? To obtain information on this problem, the surface soil has been removed from experimental plots at Wooster and other places and the sub-soil subjected to experiments with different crops and soil treatments.

Testing the Soil's Need for Specific Nutrients

Regarding specific materials used on arable land, the great importance of lime as a primary requirement on certain soils was amply demonstrated at different centers. At the Jennings County Experiment Field liming is the backbone of any successful system of soil management. Phosphate is also of primary importance on this farm. Another interesting result obtained from the long continued use, particularly of phosphate, both in Indiana and Ohio, is the increasing need for potash in crop production. As illustrating this point, the data in Circular 224 reporting the Jennings County experiments give the results of the fertility tests under different treatments for the past 16 years. The returns from the use of potash have been more than doubled in the last eight-year period 1930-38 compared to the results from the same treatment for the previous eight-year period 1921-29. The need for nitrogen fertilizers and the relation of legumes to the nitrogen supply were also discussed.

A number of other experimental fields and plot series were visited. Among them were series of plots planned to determine the best time for cutting clover and alfalfa. Fortunately, both Indiana and Ohio experiment stations published very excellent reports which carry not only the data of the treatment involved but the practical results that have so far been obtained from such work. The Handbook of Experiments in Agronomy, published by the Ohio Agricultural Experiment Station together with its supplement covers some 140 pages. As a conclusion to the description of each experiment a practical recommendation is usually given. In Circular 224 already referred to, giving the results of the Jennings Farm, are excellent practical recommendations, as for instance—"How to treat this kind of land."

Experimental work is vital to a more efficient crop production, but of equal importance is the intelligent application of the results of such work to practical crop production and as a stimulus to experimental and research work in other areas. This practice of holding summer meetings and tours to actually see what is going on and giving, as it does, an opportunity to exchange information and ideas is a development that needs all the support that can be given.

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

¶ Two new bulletins detailing the results obtained from fertilizer placement for Henderson Bush lima beans and for potatoes are noteworthy accessions to the valuable data recorded for other crops in recent years. Placement studies with lima beans have been under way for 4 years at the Virginia Truck Experiment Station, and are summarized in Bulletin 99, "Placement of Fertilizer for Henderson Bush Lima Beans in Virginia," by M. M. Parker of the Station staff, and G. A. Cumings, U. S. D. A., Bureau of Agricultural Engineering. G. A. Cumings, as co-author with G. V. C. Houghland of the other publication on this subject, gives a complete discussion of the extensive potato fertilizer studies conducted over a period of 7 years in Maine, New York, New Jersey, Virginia, Ohio, and Michigan in U. S. D. A. Technical Bulletin 669, "Fertilizer Placement for Potatoes."

Based on the Virginia work, the authors conclude that the fertilizer for Henderson Bush Beans should preferably be applied at the time the seed is planted. The fertilizer should be applied by a machine that places it in narrow bands 2 inches to each side of the row and 1 to 2 inches below the seed level. Where the planting of beans does not justify the purchase of additional machinery for applying the fertilizer in this manner, the fertilizer may be applied broadcast just before planting or as a side-dressing immediately after the seedlings emerge. These placements are superior to mixing the fertilizer with the soil or band placement directly under the seed.

Fertilizer placed in a band 2 inches to each side of the row and on the lower level of the seed piece also proved to be the best application method for potatoes, according to the data secured by Cumings and Houghland. Crop differences resulting from the fertilizer placement were usually greater in the eastern than in the midwestern experiments where the rates of fertilizer application were lower. Single- and double-strength fertilizers supplying equivalent amounts of plant food gave similar results, both with respect to actual potato yields and the order of yields for the various placements.

¶ Many helpful hints regarding some of the fundamentals and practices of vegetable soil fertilization under Oregon conditions are contained in Oregon Extension Bulletin 524 entitled, "Fertilizers for Vegetable Crops," by A. G. B. Bouquet. The author states that a vegetable grower must follow a sound program of soil improvement and fertilization to produce large yields of high quality crops per acre. Besides stressing the efficient use of commercial fertilizers, the bulletin explains the value of organic matter, stable manure and green manure as part of the soil improvement program.

In Oregon, nitrogen is a very important factor in crop growth, but its efficiency in general seems to be increased where materials supplying phosphorus and potash are used with it. Analyses of complete fertilizers for certain crops are suggested, although growers of the

major vegetables should also consult their county agricultural agent for additional advice, because of their knowledge of local soil conditions. Analyses having a 1-3-3 ratio, as the 4-12-12, are suggested for cabbage and related crops, celery, and lettuce. The 1-2-1, 1-3-1, and 1-4-1 ratios may be applicable for tomatoes, peas, onions, eggplants, and other vegetables. Methods of placement and other important considerations are also explained.

"Fertilization of Apple and Prune Orchards in Idaho," Agr. Exp. Sta., Moscow, Idaho, Bul. 226, Dec. 1938, Lowell R. Tucker.

"A Fertility Program for Celery Production on Everglades Organic Soils," Agr. Exp. Sta., Gainesville, Fla., Bul. 333, March 1939, J. R. Beckenbach.

"Toledo Soil Experiment Field 1913-1938, General Summary of Results," Agr. Exp. Sta., Urbana, Ill., Mimeo., May 1939, F. C. Bauer and P. E. Johnson.

"Nutrient Solution Methods of Greenhouse Crop Production," Agr. Exp. Sta., Lafayette, Ind., Revised Cir. 232, Oct. 1938, R. B. Withrow and J. P. Biebel.

"Effects of Fertilizer Applications and Other Cultural Practices on Some Kernel Characteristics of Winter Wheat," Agr. Exp. Sta., Lafayette, Ind., Bul. 432, Oct. 1938, J. T. Sullivan, H. R. Kraybill, C. B. Gustafson, G. H. Cutler, G. A. Brinson, R. R. Mulvey, and G. P. Walker.

"Fall Fertilization of Peach Trees in the Sandhills," Agr. Exp. Sta., Raleigh, N. C., Bul. 321, April 1939, C. F. Williams.

"Nitrogen Fertilization of Bearing Elberta Peach Trees in the Sandhills," Agr. Exp. Sta., Raleigh, N. C., Bul. 322, April 1939, C. F. Williams.

"Control of Crop Nutrition by the Method of Foliar Diagnosis," Agr. Exp. Sta., State College, Pa., Bul. 378, April 1939, Walter Thomas and Warren B. Mack.

Soils

¶ Research Bulletin 252 of the Iowa Agricultural Experiment Station, "Yield Tests and Land Valuation," by W. G. Murray, A. J. Englehorn, and R. A. Griffin contains an interesting discussion of methods employed in determining the valuation of farm land. A major difficulty has been encountered in Iowa in applying productivity ratings to soils on individual farms. Productivity ratings represent the average production of a soil type and not what may be expected from a soil type on a given farm. The purpose of this study was to devise a means for measuring the soil yield rating that can be used as a supplement to the general productivity ratings.

According to the data resulting from this work, depth of surface soil is more important in measuring soil productivity than soil type. The tendency for yields to increase with depth of surface soil up to 8 or 10 inches was definite and unmistakable, as was observed from a 2-year survey in several counties. There appeared to be no definite relationship between depth and yield for depths over 10 inches. Slope is associated with yield chiefly as it affects depth. High yields were found on slopes of 10 to 12 per cent with as much as 8 inches of surface soil. The steeper the slope, however, the greater the chances are that the top soil layer will be thinner, and consequently smaller the yields.

"The Relationship of Stream Flow to Precipitation on the Salt River Watershed Above Roosevelt Dam," Agr. Exp. Sta., Tucson, Ariz., Tech. Bul. 76, July 1938, Charles K. Cooperrider and Glenton G. Sykes.

"Chemical Characteristics of the Soils of the Rice Area of Louisiana," Agr. Exp. Sta., University, La., Bul. 307, March 1939, J. Fielding Reed and M. B. Sturgis.

"Soil Erosion in Minnesota," Agr. Ext. Serv., Univ. Farm, St. Paul, Minn., Ext. Pam. 58, March 1939, M. A. Thorfinnson.

"Rapid Soil Tests for Estimating the Fertility Needs of Missouri Soils," Agr. Exp. Sta., Columbia, Mo., Bul. 404, April 1939, L. D. Baver and F. H. Bruner.

"Soils in Relation to Fruit Growing in New York, Part XIV. Tree Behavior on Important Soil Profiles in the Finger Lakes Area," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., Bul. 711, Dec. 1938, Damon Boynton.

"Neutralization Curves for the Humic Acids of Peat Soils," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., Memoir 219, Feb. 1939, B. D. Wilson and E. V. Staker.

"Soil Survey, The Price Area, Utah," U. S. D. A., Washington, D. C., Series 1934, No. 13, Feb. 1939, F. O. Youngs and D. S. Jennings.

"Soil Survey, Kitsap County, Washington," U. S. D. A., Washington, D. C., Series 1934, No. 12, Jan. 1939, Robert Wildermuth, S. O. Perkins, R. E. Pasco, and Edgar H. Hubbard.

"Erosion Control in the Northeast," U. S. D. A., Washington, D. C., 8-10998, Revised Oct. 1938.

"Erosion and Related Land Use Conditions, on the Elm Creek Watershed, Texas," U. S. D. A., Washington, D. C., Jan. 1939, Harvey Oakes and Elias Somerville.

"Progress Report of the Central Piedmont Soil and Water Conservation Experiment Station, Statesville, N. C., 1930-35," U. S. D. A., Washington, D. C., SCS-ESR-6, Oct. 1938, F. O. Bartel and C. S. Slater.

"Progress Report of the Blackland Soil and Water Conservation Experiment Station, Temple, Tex., 1931-36, U. S. D. A., Washington, D. C., SCS-ESR-7, Dec. 1938, E. B. Deeter and P. L. Hopkins.

"Progress Report of the Northwest Appalachian Soil and Water Conservation Experiment Station, Zanesville, Ohio, 1933-37," U. S. D. A., Washington, D. C., SCS-ESR-8, Jan. 1939, H. L. Borst and Russell Woodburn.

"Advance Report on the Sedimentation Survey of Burlington Reservoir, Burlington, North Carolina, April 16 to May 21, 1938," U. S. D. A., Washington, D. C., SCS-SS-28, Dec. 1938, Mark P. Connaughton and Jack L. Hough.

"Advance Report on the Sedimentation Survey of Barcroft Reservoir, Alexandria, Virginia, September 17, 1937-March 8, 1938," U. S. D. A., Washington, D. C., SCS-SS-29, Jan. 1939, Farrell F. Barnes.

"A Study of Some of the Older Strip Cropping in Ohio, Pennsylvania, and West Virginia," U. S. D. A., Washington, D. C., SCS-TP-20, Jan. 1939, H. H. Morse and H. B. Alger.

Crops

¶ "Tobacco Growing in Canada" is the title of Publication 663, Farmers' Bulletin 68, Dominion of Canada—Department of Agriculture, by N. A. MacRae. This publication will fill the demand for the preceding Bulletin number 25 which was issued over twenty years ago and is now out of print. The present issue deals briefly and concisely with the more important phases of tobacco production, including a description of types and varities grown in Canada, adapted soils and fertilizers, cultural operations, methods of harvesting and curing, diseases and insects.

Except for certain types of pipe tobaccos produced in the province of Quebec, the types and varieties grown in Canada and the United States are similar. For this reason, soil and fertilizer requirements also are similar. Although tobacco is grown in practically every province in the Dominion, Ontario and Quebec comprise the chief areas of commercial production, with a smaller region in British Columbia. Production reached its peak in 1938 with a crop of 96 million pounds.

The advice and recommendations given in this new bulletin are based on scientific experimental work obtained throughout the Dominion, and should be of profound interest to all tobacco growers in Canada.

"Grapes in Arizona," Agr. Exp. Sta., Tucson, Ariz., Bul. 162, Feb. 1939, A. H. Finch, R. H. Hilgeman, H. F. Tate, R. B. Streets, and L. P. Wehrle.

"Problems of Water Resources for Rice Irrigation," Agr. Exp. Sta., Fayetteville, Ark., Bul. 371, Feb. 1939, Deane G. Carter and Kyle Engler.

"Toward Better Agriculture," Agr. Exp. Sta., Univ. of Calif., Berkeley, Calif., C. B. Hutchison and S. B. Freeborn.

"Hilgardia," Univ. of Calif., Berkeley, Calif., Vol. 12, No. 5, Feb. 1939.

"Fifty Years of Progress on Dominion Experimental Farms, 1886-1936." Ottawa, Ontario, Canada, 1939.

"Annual Report of the Department of Agriculture of the Province of New Brunswick for the Year Ended October 31st, 1938," Fredericton, N. B., Canada.

"Fiftieth Anniversary, 1888-1933, Agr. Exp. Sta., Storrs, Conn., Bul. 228, Oct. 1938.

"Sixty-first Report of the Connecticut Agricultural Experiment Station for the Year 1937," Agr. Exp. Sta., New Haven, Pub. Document 24, 1937.

"Biennial Report of the Commissioner of Agriculture for the Fiscal Period July 1, 1936 to June 30, 1938," Com. of Agr., Hartford, Conn., Pub. Doc. 18, 1938.

"Crop Rotation Studies," Agr. Exp. Sta., Moscow, Idaho, Bul. 227, Dec. 1938, G. Orien Baker and K. H. W. Klages.

"Eighteen Varieties of Edible Soybeans," Agr. Exp. Sta., Urbana, Ill, Bul. 453, Mar 1939, J. W. Lloyd and W. L. Burlison.

"Report on Agricultural Research for the Year Ending June 30, 1938, Part II, Iowa Corn Research Institute Third Annual Report," Agr. Exp. Sta., Ames, Iowa.

"Hybrid Corn in Kansas," Agr. Exp. Sta., Manhattan, Kan., Cir. 196, Feb. 1939, R. W. Jugenheimer.

"Biennial Report of the Northeast Louisiana Experiment Station, St. Joseph, Louisiana, 1937-1938." Agr. Exp. Sta., St. Joseph, La., C. B. Haddon.

"Annual report of the Maine Extension Service for the Year Ending June 30, 1938," Agr. Ext. Serv., Orono, Maine, Ext. Bul. 254, Dec. 1938.

"Maine Fruit Notes," Agr. Ext. Serv., Orono, Maine, Vol. 13, Nos. 2 and 3, April 1939.

"Fruit Notes," Agr. Ext. Serv., Amherst, Mass., April and May 1939.

"Establishing Apple Orchards," Agr. Ext. Serv., Amherst, Mass., Ext. Leaf. 182, April 1939, J. K. Shaw.

"The Massachusetts Commercial Vegetable Grower," Agr. Ext. Serv., Amherst, Mass., No. 18, April 1939.

"Haying in the Rain, A Study of Grass Silage," Agr. Exp. Sta., Amherst, Mass., Bul. 362, April 1939, J. G. Archibald and C. H. Parsons.

"Causes and Effects of Size Differences in Apple Trees in the Nursery," Agr. Exp. Sta., East Lansing, Michigan, Tech. Bul. 163, May 1939, F. C. Bradford and Lloyd Joley.

"The Quarterly Bulletin," Agr. Exp. Sta., East Lansing, Mich., Vol. 21, No. 4, May 1939.

"Forty-fifth Annual Report, July 1, 1937 to June 30, 1938," Agr. Exp. Sta., University Farm, St. Paul, Minn.

"Improved Varieties of Farm Crops," Agr. Ext. Serv., Univ. Farm, St. Paul, Minn., Ext. Folder 22, Revised March 1939.

"Pasture Plants and Combinations," Agr. Ext. Serv., Univ. Farm, St. Paul, Minn., Ext. Bul. 197, March 1939.

"Mississippi Farm Research," Agr. Exp. Sta., State College, Miss., Vol. 2, Nos. 4 and 5, April and May 1939.

"Development and Care of Lawns," Agr. Exp. Sta., Columbia, Mo., Cir. 204, April 1939, Horace F. Major.

"Some Effects of Temperature on the Growth and Chemical Composition of Certain Pasture Grasses," Agr. Exp. Sta., Columbia, Mo., Res. Bul. 299, April 1939, E. Marion Brown.

"50 Years of Achievement, Agricultural Investigation," Agr. Exp. Sta., Lincoln, Nebr., Cir. 60, March 1939.

"Problems in the Production of Iceberg Lettuce in New York," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., Bul. 714, March 1939, J. E. Knott, E. M. Anderson, R. D. Sweet.

"The Effect of Temperature on the Photoperiodic Response of Spinach," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., Memoir 218, Jan. 1939, J. E. Knott.

"Bimonthly Bulletin," Agr. Exp. Sta., Fargo, N. Dak., Vol. I, No. 5, May 1939.

"The Bimonthly Bulletin," Agr. Exp. Sta., Wooster, Ohio, Vol. XXIV, No. 198, May-June 1939.

"The Farm Vegetable Garden," Agr. Ext. Serv., Corvallis, Oreg., Ext. Bul. 525, Feb. 1939, A. G. B. Bouquet.

"Annual Report of the Agricultural Experiment Station, Fiscal Year 1937-38," Agr. Exp. Sta., San Juan, P. R., 1939, J. A. B. Nolla, Dir.

"Snap Bean Production in South Carolina," Agr. Exp. Sta., Clemson, S. Car., Cir. 59, March 1939, J. Mitchell Jenkins, Jr.

"A History of Extension Work in Tennessee, Twenty-five Years of Service to Rural Life, 1914-1939," Agr. Ext. Serv., Knoxville, Tenn., Pub. 223, May 1939, Almon J. Sims.

"Some Physiological Responses to Close Pruning of Northern White Pine," Agr. Exp. Sta., Burlington, Vt., Bul. 444, Jan. 1939, W. R. Adams and M. R. Schneller.

"Early Cut Artificially Dried Hays for Dairy Cows," Agr. Exp Sta., Burlington, Vt. Bul. 446, April 1939, O. M. Camburn and O. H. Jones.

"Seed Flax in Eastern Washington," Agr. Exp. Sta., Pullman, Wash., Bul. 370, Mar. 1939, O. E. Barbee and E. G. Schafer.

"Thirteenth Biennial Report of the West Virginia Department of Agriculture, 1937-1938," Dept. of Agr., Charleston, W. Va., J. B. McLaughlin, Com.

"What's New in Farm Science, Part II, Annual Report of the Director," Agr. Exp. Sta., Madison, Wis., Bul. 443, March 1939.

"Report on the Agricultural Experiment Stations, 1938," U. S. D. A., Washington, D. C., April 1939, J. T. Jardine and F. D. Fromme.

"The Northstar Strawberry," U. S. D. A., Washington, D. C., Cir. 517, Dec. 1938, George M. Darrow.

"Native and Adapted Grasses for Conservation of Soil and Moisture in the Great Plains and Western States," U. S. D. A., Washington, D. C. Farmers' Bul. 1812, Feb. 1939, M. M. Hoover.

"Date Growing in the United States," U. S. D. A., Washington, D. C., Leaf. 170, Feb. 1939, Roy W. Nixon and Dewey C. Moore.

"Dwarf Fruits," U. S. D. A., Washington, D. C., Leaf. 178, Feb. 1939, H. P. Gould.

"How to Keep and Increase Black Grama on Southwestern Ranges," U. S. D. A., Washington, D. C., Leaf. 180, R. S. Campbell and Edward C. Crafts.

"Bruising, Freezing, and Chemical Injury of Potatoes in Transit," U. S. D. A., Washington, D. C., Tech. Bul. 668, Feb. 1939, R. C. Wright.

Economics

¶ For a number of years the University of Missouri Agricultural Experiment Station has published a fertilizer bulletin entitled "Registration, Labeling, and Inspection of Commercial Fertilizers." In Bulletin 403 for 1938, the practice of reporting the tonnages of the various analyses was changed somewhat from previous years. In the past, fertilizer manufacturers have been asked to report their sales on weekly shipment statements. It was felt that these reports were somewhat incomplete, and in 1938 the companies were asked to

cooperate by supplying annual figures in place of the weekly figures, and it is believed that in this way the data has been improved upon. The total tonnage from shipment reports for 1938 was 57,068 tons, of which 40,307 tons were sold in the fall, and 16,761 tons in the spring. This compares to estimated consumption for the State of 70,301 tons based on tag sales. The percentage coverage by the company reports apparently is sufficient to furnish a very good indication of the relative importance of the different analyses sold. Of the total tonnage of 63,674 tons reported in the annual summary, 23,662 tons were superphosphate, 9,806 tons were high grade mixed fertilizers, 25,940 tons were medium grade mixed fertilizers, and only 4,266 tons of low grade and miscellaneous mixtures were sold. In the mixed fertilizer list, the leading analysis was 2-12-2 and was followed by 2-12-4, 2-12-6, and 4-12-4.

The estimated tonnage of nitrogen contained in the 1938 fertilizer tonnage was 1,001 tons, available phosphoric acid 8,971 tons, plus phosphoric acid from bone, 398 tons, and 49 tons of insoluble phosphoric acid. The total potash content was 1,442 tons.

¶ According to the latest Report of the Control Division of the Kansas State Board of Agriculture for the Quarter Ending June 1939, the total fertilizers reported sold by manufacturers in Kansas was 13,828 tons as compared to 12,114 tons in 1937. According to the tag sale reports, total sales in Kansas in 1938 were 18,099 tons. This would lead us to believe that 4,200 tons were sold but not reported to the Control Division. Although the reports apparently are not 100% complete, the tonnage tables in the various grades sold furnish a very good indication of the relative importance of the different analyses of fertilizers consumed in Kansas. Kansas is still a very young fertilizer consuming state and by far the most important fertilizers sold are 20% superphosphate and 45% superphosphate. The 45% superphosphate is the leading analysis, with 4,740 tons reported, as compared to 4,072 tons for 20% superphosphate. Relatively small tonnages of the other materials were reported. The leading mixed fertilizer is still the 2-12-2 which is losing out rapidly in the older fertilizer consuming states in the Middle West. The next most important analyses in mixed goods are 2-12-4, 2-12-6 and 4-12-4.

"Commercial Fertilizers Agricultural Minerals, 1938," Dept. of Agr., Sacramento, Calif., Sp. Pub. 165, May 1939.

"Consumption of Fertilizer Materials by Counties of Florida for Months of March 1939 and April 1939," Fer. Stat. Div., Bu. of Inspec., Com. of Agr., Tallahassee, Fla., Nathan Mayo, Com.

"Consumption of Mixed Fertilizers by Counties of Florida for Months of March and April 1939," Fer. Stat. Div., Bu. of Inspec., Com. of Agr., Tallahassee, Fla., Nathan Mayo, Com.

"Connecticut Crop and Livestock Review 1938," St. Dept. of Agr., Hartford, Conn., Bul. 60, May 1939.

"Illinois Farm Economics," Agr. Ext. Serv., Urbana, Ill., Nos. 47 & 48, April & May 1939.

"Indian Crops and Livestock," Agr. Exp. Sta., West Lafayette, Ind., No. 164, May 1, 1939.

"Crop Report for Michigan, April 1939," St. Dept. of Agr., Lansing, Mich., Verne H. Church and Cecil J. Borum.

"Farm Economic Facts," Agr. Ext. Serv., Amherst, Mass., Vol. XII, Nos. 4 & 5, April & May 1939.

"Farm Business Notes," Agr. Ext. Serv., University Farm, St. Paul, Minn., Nos. 196 & 197, April & May 1939.

"Farm Adjustments in Montana, Study of Area VII: Its Past, Present, and Future," Agr. Exp. Sta., Bozeman, Mont., Bul. 367, Mar. 1939, Neil W. Johnson.

"Farm Economics," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., No. 113, May 1939.

"Current Farm Economics," Agr. Exp. Sta., Stillwater, Okla., Series 49, Vol. 12, No. 2, April 1939.

"Department of Agriculture of Oregon Bulletin," St. Dept. of Agr., Salem, Oreg., No. 88, April 1939.

"Methods and Costs of Marketing Potatoes in Pennsylvania," Agr. Exp. Sta., State College, Penna., Bul. 372, Feb. 1939, W. R. Whitacre.

"Department of Agriculture—Immigration of Virginia," St. Dept. of Agr., Richmond, Va., Buls. 368, 369, 370, March, April, & May.

"Sugar Consumption Requirements and Quotas for the Calendar Year 1939," U. S. D. A., Washington, D. C., G. S. Q. R., Series 6, No. 1, Rev. 1, Mar. 31, 1939.

"Amendment to Determinations of Proportionate Shares for Sugarcane Producers in

Puerto Rico for the Crop Years 1938, 1939, and 1940," U. S. D. A., Washington, D. C., S. D. No. 55, April 4, 1939.

"Cigar-tobacco Adjustment Through the A. A. A.," U. S. D. A., Washington, D. C., Reg. Inf. Series, NER Leaf. 326, 1939.

"Annual Report on Tobacco Statistics, 1938," U. S. D. A., Washington, D. C., Stat. Bul. 67, Dec. 1938.

"A Graphic Summary of Farm Animals and Animal Products," U. S. D. A., Washington, D. C., Misc. Pub. 269, Feb. 1939, O. E. Baker.

"1939 Agricultural Conservation Program—Delaware," U S. D. A., AAA, Washington, D. C., ECR-301-Del., April 1939.

"1939 Agricultural Conservation Program—Kentucky," U. S. D. A., AAA, Washington, D. C., ECR-301-Ky., April 1939.

"1939 Agricultural Conservation Program—Maryland," U. S. D. A., AAA, Washington, D. C., ECR-301-Md., April 1939.

"1939 Agricultural Conservation Program—North Carolina," U. S. D. A., AAA, Washington, D. C., ECR-301-N. C., April 1939.

"1939 Agricultural Conservation Program—Tennessee," U. S. D. A., AAA, Washington, D. C., ECR-301-Tenn., April 1939.

"1939 Agricultural Conservation Program—West Virginia," U. S. D. A., AAA, Washington, D. C., ECR-301-W. Va., April 1939.

"1939 Agricultural Conservation Program—Virginia," U. S. D. A., AAA, Washington, D. C., ECR-301-Va., April 1939.

"Cost of Production of Citrus Fruits, Data from Studies in California and Florida Selected Years, 1910-37," U. S. D. A., Washington, D. C., Dec. 1938, H. W. Hawthorne.

"Disadvantaged Classes in American Agriculture," U. S. D. A., Washington, D. C., Social Research Rpt. VIII, April 1938, Carl C. Taylor, Helen W. Wheeler, and E. L. Kirkpatrick.

The Chemical Formulary

ANYONE desiring the formula for almost anything imaginable will probably save himself time and trouble if he first looks in the latest edition of the Chemical Formulary 1939 (Chemical Publishing Co., Inc., New York, $6.00). This is the fourth volume of the series and contains the latest formulae of an extraordinarily large list of preparations, collected under the editorship of H. Bennett with the assistance of a large number of technical and scientific experts.

A general introductory chapter giving suggestions on procedures to be followed in compounding preparations is followed by sections devoted to adhesives, beverages, liquors, flavors, cosmetics, drugs, emulsions, farm and garden specialties, food products, inks, leather, skins, furs, lubricants, oils, fats, materials of construction, paints, varnishes, lacquers, paper, photography, plating, polishes, abrasives, pyrotechnics, rubber, resins, plastics, waxes, soap, cleansers, textiles, fibers, and miscellaneous preparations. Concise but complete directions for making the preparations are given. At the end of the book, lists of ingredients are given, and where they may be purchased.

Many of the preparations are important in agricultural lines, among them grafting wax, plant pest and disease sprays, leather and fur preparations, various paints, and similar materials too numerous to mention. The book is an exceedingly handy reference for those wanting information on those hard-to-find directions of "how to prepare it".

Foreign and International Agriculture

To supply information on agricultural research in other countries, titles and a few descriptive remarks of principal articles in the two magazines "Die Ernährung der Pflanze," published in Berlin, Germany, and "La Potasse," published in Mulhouse, France, are given here. Due to space limitation, only articles of general fundamental interest are given, although both magazines contain other articles of local interest and abstracts of outstanding articles in other publications.

Die Ernährung der Pflanze, May 1939, Vol. 35, No. 5

FERTILIZATION AND THE COURSE OF NUTRIENT ABSORPTION. *By T. R. Remy, Bonn, Germany.*

This article is a condensation of an article which appeared in *Soil Science,* September 1938. The author summarizes the general underlying relationships of nutrient absorption by plants. Among the factors influencing absorption are the kind of plant, its environment, and stage of development. Nutrient absorption precedes synthetic activity in young plants, but as plants become older, this order is gradually reversed. Absorption and synthesis cease before maturity of seed, a fact which may be masked by secondary growth. A plentiful supply of nutrients may result in the plant absorbing more than required for its immediate needs, storing the excess against future needs. Early fertilization with potash and phosphoric acid presents no danger to the plant and little loss by leaching, but more care must be taken with nitrogen fertilization. Applying fertilizers late in the life of the plant is likely to have more serious consequences. It may lead to undesirable secondary growth, or the nutrients may be absorved but not utilized by the maturing plants, thus not producing any benefit in yield or quality of crop.

The various nutrients may not be absorbed at the same rate, and at times, absorption may be negative, due to leaching from the plant, or return through the roots to the soil being greater than absorption. In studying nutrient absorption by plants, the author stresses the importance of selecting plants that are of equal physiological development and health, that well-differentiated periods of physiological development, rather than calendar periods, be taken for period divisions, and that observations be made upon a sufficient number of plants to permit a valid conclusion to be drawn.

After making these generalizations, the author considers individual plants and groups of plants, tracing the absorption of nutrients by them, and how this should determine their fertilization. Plants are divided into two large groups, based on their course of nutrient absorption. In one group, the absorption of nutrients takes place rapidly, with a marked period of maximum absorption, occurring at a time when the soil is dormant and the root development poor. In the other group, absorption takes place more slowly over a longer period of time, with a maximum period not so marked, and when the soil is more active and roots better developed. In the first group, the soil must be in very good condition before planting, and rapidly acting fertilizers must be used. In the latter case, the plants are better able to forage in the soil, and slowly acting fertilizers may be used.

The individual groups of plants are then considered. Fall-sown grains absorb only about 10% of their nutrients in the fall, and nearly all the nitrogen is absorbed in the spring. The period of greatest absorption is during stalk and head development, with a gradual

decrease from blossoming to maturity. Nitrogen fertilizer can be supplied by top-dressing in the spring, and even potash and phosphates can be applied in this manner if they are not applied in the fall before seeding. Spring grains have a shorter period of absorption, and a marked period of high requirement. Quickly acting fertilizers should be applied at or before seeding.

The hoed crops, such as potatoes, beets, cabbage, etc., have a comparatively long period of absorption during summer, and for these, slowly acting manures and fertilizers should be used. Perennial crops require large amounts of nutrients for the formation of well-developed roots, with plenty of food reserves in them. Following this period of root development, further nutrients are needed each year to renew the reserves for the following year. In addition to fertilization to take care of these needs, the crops should not be harvested too late to permit the plant to develop the necessary root reserves. Rapidly growing vegetable crops have high nutrient needs over a comparatively short period of time, therefore need generous fertilization with quickly acting fertilizers, in addition to a soil in good condition.

THE RESERVES OF POTASH IN THE SOIL. *By P. Schachtschabel, Jena, Germany.*

The author states that the various laboratory methods used to determine the potash needs of soils extract only a part of the available potash present. The total available potash reserves are seldom determined, largely because of the concept that these are only very slowly available. It has been pointed out however that there is an equilibrium between the quickly and slowly available potash which may cause the less active potash to become more active, or under other conditions, the more active to go over into a less active form, even to the extent that the potash is spoken of as being fixed by the soil. The latter condition is most likely to occur if the soil is farmed for a period with insufficient potash fertilizer, so that the less active reserves are called on. Later, when potash fertilizer is used, it is taken up by the soil and transferred to the less active form, with the result that it does not produce the expected results with respect to crop yield; thus the danger of drawing too heavily on the reserve potash in the soil without systematic replacement.

The replaceable potash has long been considered the available potash in the soil. More recently, it has been shown that the plants can use also non-replaceable potash. The author believes that there is no fundamental difference between the two, the differentiation being due to the time of extraction with the various solutions employed. Plants can remove more of the potash than certain neutral salt or weak acid solutions, since they are in more intimate contact with the soil particles, and act for a considerable length of time. Data are given to support this contention.

The author also conducted experiments using the Neubauer seedling method of removing the available potash from the soil. Repeated cultures on the same soil sample yielded further potash, showing that a single culture did not remove all the available potash. Similar high results were obtained when the amount of soil employed for the culture was reduced, which had the effect of a more concentrated attack on the soil by the seedlings. The amounts of available phosphoric acid and potash extracted by the seedlings would be increased up to two to three times the amount obtained in the conventional way, the increase being greater in the soils with higher colloidal contents. Attention is called to the fallacy of placing too much value on these higher amounts, since the seedlings are growing under much more favorable conditions than are likely to exist in the soil. If fertilizers are applied on the basis of these higher values, there is grave danger of soil fixation in unfavorable years, with consequent decreased crop yields.

THE GROWTH OF THE HORSE-RADISH IN RELATION TO ITS UPTAKE OF PLANT FOOD. *By J. Becker-Dillingen and A. Wetzel, Berlin, Germany.*

Horse-radishes are usually grown very intensively, with large applications of manure and fertilizers. Carefully planned experiments were inaugurated to permit the accurate determination of the nutrients used by the crop. These showed that a yield of about 6 tons of roots per acre used about 200 pounds of nitrogen, 100 pounds of phosphoric acid, 450 pounds of potash, and 315 pounds of lime per acre. Several experiments conducted in various parts of Germany indicate that best results are obtained if total manuring and fertilization supply about these quantities of nutrients. During the first 2 months of growth, the nutrients are taken up very slowly by the plants, due apparently to the utilization of nutrients already contained in the seed roots. Following this the absorption during the next 2 months is very rapid, with the maximum reached a little after 4 months of growth. From this point to maturity, there is a return of nutrients to the soil due to leaf fall and leaching, and possibly through the roots.

PHOTOGRAPHIC PRESENTATION OF SEED AND FRUIT OF IMPORTANT CULTIVATED MEDICINAL, FRAGRANT, AND CONDIMENT PLANTS. *By A. Pietsch, Perleberg, Germany.*

This is another section of the compilation on the subject being made by the author. The various items covered were described in the April issue of this magazine.

POTASH IN PLANT METABOLISM. *By G. N. Hoffer, Lafayette, Indiana.*

Abstract of a paper which appeared in the August 1938 issue of the *Journal of Industrial and Engineering Chemistry*. The author describes the functions of potassium and its relationships to the various physiological processes occurring in plants. The effects of potash deficiency on plants, and particularly on their appearance are described. Reprints of the original article are available.

THE LONG-TIME EXPERIMENTS OF THE BERNBURG EXPERIMENTAL FIELD. *By W. Krüger, Bernburg, Germany.*

One of the fields of the Anhalt Experiment Station has been growing potatoes continuously for 25 years, with different plots receiving the same individual fertilizer treatments during that period. The soil was originally fertile, particularly with respect to potash. On all plots not receiving potash, deficiency symptoms characteristic of a lack of this nutrient soon developed. These were intensified by unbalanced fertilization lacking potash. Yields were correspondingly low. Manure alone increased yields considerably, but potash deficiency was observed. Best results were obtained with manure and a complete fertilizer. Starch yields were affected similarly to total tuber yields. Determinations of the available potash in the soil by the Neubauer method showed that when no potash was applied the supply of this nutrient in the soil fell very rapidly, in spite of the rather high initial content. Of particular interest in this experiment is the fact that potatoes could be grown continuously on a soil for such a long period, with such good yields, when well manured and fertilized.

GROWING COTTON IN ITALY.

This short article gives a few notes on cotton growing in Italy. The crop is confined to the southern part of the country and Sicily, and the acreage planted has increased considerably in recent years, although it still is much below the acreages planted in the last century. The intermediate types are grown, the Alcala variety being popular. Fertilization is still being investigated, but for the most part, a fertilization con-

sisting of 80-120 pounds of phosphoric acid and 50-100 pounds of potash per acre is used. Only moderate amounts of manure or nitrogen are applied.

PLANT QUALITY, THE FOOD OF THE NATION, AND FERTILIZATION. *By M. Ott, Darmstadt, Germany.*

Much attention has been paid in recent years to the influence of fertilization on the quality of the produce, vitamine content, among other things, being studied. The results have been somewhat confusing with respect to the influence of fertilization of vitamine content of crops, but in general it may be said that a well-balanced fertilizer usually results in a high vitamine content of crop. While there are some marked exceptions to this, the total vitamine production per unit area of land is almost without exception higher with a good fertilization. An unbalanced fertilization usually results in a lower vitamine content of the crop. Some experiments with tomatoes, white cabbage, and red cabbage are quoted in this abstract.

FERTILIZER EXPERIMENTS ON CORN. *By W. Sauerlandt, Landsberg, Germany.*

Various organic fertilizers and mineral nitrogen fertilizers were compared on corn and potatoes. The organic materials did not seem to do as well on corn as on potatoes, the inorganic nitrogenous materials doing relatively better on corn. The nitrogen, phosphoric acid, and potash absorbed by the various parts of the plants with various treatments also were determined. The nutrient absorption seemed to be rather high compared to corn grown in this country, undoubtedly reflecting the heavier fertilization in Germany. The nutrient contents of the grain of several varieties also were determined, considerable variation being exhibited. An experiment to determine the size of plot necessary for accurate results showed that small plots of about 10 square yards were satisfactorily accurate.

MINERALS IN POULTRY NUTRITION. *By H. D. Branion, Guelph, Ontario.*

This comprehensive survey of the subject of mineral nutrition of poultry originally appeared in *Scientific Agriculture* for January 1938. Most attention has been paid to the composition on the skeleton due to the high mineral content of this part of the fowl, but the important role played by minerals in the softer tissues should not be neglected, in the opinion of the author. He points out that most attention rightly is given to calcium, phosphorus, sodium, and chlorine, since the chicken requires large amounts of these minerals, and they tend to be contained in lesser amounts in the foods ordinarily fed. The actions of several other mineral elements also are discussed, and chemical analyses of the chicken and the egg are given.

THE NUTRIENT NEEDS OF THE OIL PALM. *By R. Wilbaux, Belgian Congo.*

The author presents data on the mineral contents of different varieties of oil palms and for the various parts of the plant. These figures obtained at experiment stations in the Belgian Congo are compared with those from other locations. The total mineral removal of a normal crop varying between 3,500 and 7,500 pounds of fruit per acre according to variety, amounts to 65-83 pounds nitrogen, 15-24 pounds phosphoric acid, 70-95 pounds potash, 30-35 pounds lime, and 17-23 pounds magnesia.

La Potasse, April 1939, Vol. 13, No. 120

POTASH FERTILIZATION ON THE GRANITIC SOILS OF BRITANY. *By Vincent, Boischot, and Herviaux, Quimper, France.*

On a fertile granitic soil at Quimper, the authors found that the application of 100 or 200 pounds per acre of muriate of potash did not increase the yield

of three varieties of wheat. Since this soil contained .0386 per cent available potash, the conclusion was drawn that when this amount is present, no increase from potash fertilization is to be expected on this crop. However, when this soil was cropped 3 years without potash fertilization, the yields as well as the available potash in the soil fell rapidly. Even on the potash-fertilized plot, the available potash in the soil was reduced to less than a third of the original amount, since the 250 pounds per acre added were offset by 585 pounds removed by the crops. Clover grown on plots with and without potash was analyzed, that on the potash plots being higher in potash and lower in calcium. The residual effects of 300 pounds of muriate of potash on potatoes were such that the yield of the wheat next year was increased 24.4% and of potatoes the second year following, 12.3%.

RAISING POULTRY ON THE BRETON MARSH. *By R. de Dreuzy, France.*

A general description of the Breton Marsh in western France is given. Most of the article is devoted to the methods followed by those living in this section in raising livestock, and particularly chickens and ducks, which furnish most of the income to the farmers.

THE INFLUENCE OF FERTILIZERS ON THE PHYSICAL PROPERTIES OF SOILS.

The results of the effects of various fertilizer treatments on the physical properties of soils, made at the experiment station at Versailles are summarized. It was found that the use of fertilizers containing sodium caused deflocculation in heavy soils. This reduced air space, and made the soil much harder to work. Manure and lime were beneficial in this respect, while sulphate of potash was without effect. It is concluded that the use of low analysis potash salts should be confined to light and to calcareous soils, using the concentrated muriate or sulphate of potash on heavy soils.

THE FERTILIZATION OF POPLARS. *By H. Hubert, France.*

A planting of poplar trees has been fertilized for 7 years with some of the trees unfertilized. At the end of this time, the fertilized trees were about one-third larger than the unfertilized. It is stated that the wood of fertilized trees is more valuable since it is less knotty. The fertilizer used was 8-13-19, the rate of application increasing from about a half a pound to over 2 pounds per tree during this period.

THE PRODUCTION OF FISH PONDS IS IMPROVED BY FERTILIZERS.

Most of the article is devoted to a review of the article on fish pond fertilization by A. S. Swingle in the February 1939 issue of BETTER CROPS WITH PLANT FOOD. His recommendations are compared to those obtained in France, in which about 30 pounds per acre of phosphoric acid and 20 pounds of potash were used. A grower in the country, based on personal experience, recommends the use of 500 pounds of limestone, 50 pounds of bicalcic phosphate, and 40 pounds of nitrate of potash per acre, worked into the soil of the pond when it has been drained and dried before reflooding and restocking.

Three Britons, each hard of hearing:
First Limey: "Is this Wembley?"
Second Pelter: "No, it's Thursday."
Third Limey: "So am I. Let's have a Scotch and soda."

Gulls were following a ferry.
Irishman: "Nice flock of pigeons."
Tourist: "Those are gulls, my man."
Irishman: Well, gulls or boys, they're a nice flock of pigeons."

More Than 100 Crops In Agricultural Industry

AGRICULTURE is commonly regarded as a single industry, but there are more than 100 separate commodities, all more or less competitive, each having its economic problems, says the Federal Bureau of Agricultural Economics. Public attention centers upon the great cotton, corn, and wheat industries. To hundreds of thousands of producers, other products are more important. All are affected by the same broad underlying economic forces but each in differing degree, influenced by the special conditions which may affect individual commodities.

The cash income from all crops combined was $3,160,025,000 in 1938 as compared with $3,845,614,000 in 1937. But within these figures were several industries which had the largest cash income in several years. The cash income from corn (a major crop) was $271,659,000 in 1938 compared with $221,757,000 in 1937. The 1938 figure was the largest since 1930. Principal reasons for the increase in 1938 were the marked increase in sales and the quantity of corn placed under Government loan. The loan proceeds are included in the estimates of income.

Peanuts were another crop showing larger income in 1938 compared with 1937. The $39,951,000 of income received by producers in 1938 was the largest in several years. The 1937 income was $36,295,000. Principal reasons for the increase in 1938 were increased sales of peanuts and relatively stable prices when compared with 1937.

Soybeans are rapidly increasing in importance as a contributor to farm income and in 1938 yielded a cash income of $31,933,000. This compared with $28,030,000 in 1937. The 1938 income from soybeans was the largest on Government record. The increase in 1938 over 1937 was due principally to the marked increase in output more than offsetting lower prices.

The 1938 cash income from clover seed (red and alsike) totaled $15,664,000 in 1938 compared with $9,862,000 in 1937. Lespedeza seed yielded $5,363,000 of cash income in 1938 as compared with $4,757,000 in 1937. The producers of maple sugar and sirup had a cash income of $4,281,000 in 1938 compared with $3,808,000 in 1937, and the growers of sweet sorghum for forage received $2,760,000 compared with $2,112,000 in 1937.

Toward Cutting the Cost of Marketing

(*From page* 16)

upon the open-mindedness of the groups concerned, the advance made, and the willingness to follow plans that the Department believes will make for success. It cannot spend time in long wrangles between local selfish interests that will not concede narrow advantages for the sake of general ultimate improvement, but it will give all reasonable aid in bringing the groups together on promising plans.

The Department of Agriculture does not have the personnel to work directly with smaller cities whose markets are strictly intra-State, but its specialists are working with State marketing agencies in such a way that, when requests for advice or aid reach the Department

Congestion sometimes makes it necessary for the men to climb over the produce in order to do their work.

from these localities, the Department can refer the request to the State agency with the assurance that the State officials will have ready access to the materials and assistance that is available to the large cities.

Balancing this work in large city markets, another program is under way in a large producing area which is also operating on disinterested principles. State and Federal marketing research specialists have been studying together the regional situation in the Southeast in such fashion that they will soon have determined the number of wholesale concentration markets needed for assembling fruits and vegetables, and the best cities for their location. Next will come a study of the layouts, equipment, and type of operation needed in each case.

Thus the acute need of cutting the costs of marketing is being vigorously attacked at both the producing and the city ends. Success of the attacks depends largely upon cooperation and informed guidance all along the line with equal interest at the producing and the consuming ends. It is distinctly a public-welfare program as well as a matter of saving untold dollars and cents for farmers and for consumers.

It Costs Little Extra To Fertilize Right

(*From page* 22)

A farmer who has soil in a medium fertility level or above is interested to know when he may profitably start to use fertilizers. These nutrient deficiencies creep up gradually due to plant-food losses in crops. It is somewhat like tuberculosis in man—too many are quite ill before they know it. But tuberculosis can now be detected by simple tests before there are any apparent symptoms of the disease. Similarly, soil tests which can be used to detect

COMPARISON OF FERTILIZER COSTS PER ACRE FOR DIFFERENT GRADES, AND CROP INCREASES NECESSARY TO PAY FOR THEM

Fertilizer grade (N–P_2O_5–K_2O)	Approximate cash price per ton in Indiana 1939	Fertilizer costs		Crop increases necessary to pay for 100 pounds fertilizer			
		Costs per 100 pounds	Cost per unit of plant food	Corn @ 50¢ per bus.	Wheat @ 70¢ per bus.	Potatoes @ 60¢ per bus.	Alfalfa @ $10 per ton
				Bus.	*Bus.*	*Bus.*	*Lbs.*
0–0–50	$45.98	$2.30	$ .92	4.6	3.3	3.8	460
0–20–0	22.80	1.14	1.14	2.3	1.6	1.9	228
0–20–10	34.87	1.74	1.16	3.5	2.5	2.9	349
0–20–20	45.88	2.29	1.15	4.6	3.3	3.8	459
0–10–20	33.82	1.69	1.13	3.4	2.4	2.8	338
0–8–24	35.43	1.77	1.11	3.5	2.5	3.0	354
0–14–6	25.93	1.30	1.30	2.6	1.9	2.2	259
0–12–12	29.07	1.45	1.21	2.9	2.1	2.4	291
3–12–12	34.66	1.73	1.28	3.5	2.5	2.9	347
2–14–4	28.12	1.41	1.41	2.8	2.0	2.3	281
2–12–6	28.12	1.41	1.41	2.8	2.0	2.3	281
2–12–12	32.77	1.64	1.26	3.3	2.3	2.7	328
2–16–8	32.77	1.64	1.26	3.3	2.3	2.7	328
2–8–16	32.77	1.64	1.26	3.3	2.3	2.7	328
3–9–18	37.05	1.85	1.23	3.7	2.6	3.1	371
3–18–9	38.00	1.90	1.27	3.8	2.7	3.2	380
4–16–4	34.11	1.71	1.42	3.4	2.4	2.8	341
4–16–8	37.34	1.87	1.33	3.7	2.7	3.1	373
4–10–6	30.21	1.51	1.51	3.0	2.2	2.5	302

declining soil fertility levels are now available so that a farmer may start to use proper fertilizers before his crop yields become too low.

Three pertinent conclusions may be deduced from a study of the above fertilizer cost figures:

(1) Since the costs per acre for the different fertilizer grades do not vary widely, one should buy the grade best suited for individual crop and soil conditions regardless of cost.

(2) In field trials comparing different grades, extremely accurate experimental work is necessary to measure small but profitable differences.

(3) When fertilizers are applied to soils already at medium or high fertility levels, profitable increases may go unnoticed, and extreme visible growth differences should not be expected.

Growing Good Tomatoes in Arkansas

(*From page* 13)

tion marketed 64 carloads of tomatoes for 194 farmers at an average of 25 cents per hundred more than cash buyers.

The Association is governed by seven directors who are elected each year in a democratic manner from the membership of the Association. The directors control the affairs of the Association, the Secretary being the Administrative officer during the shipping season.

Microbes as Factors in Soil Fertility

(*From page* 11)

tion of the microflora differed in that the peat contained a much larger number of fungi and much smaller numbers of bacteria and actinomyces than the manure. Further evidence of the influence of different types of humus and organic residues on the composition and activity of the soil microflora was obtained in Melbourne silt loam, a cultivated forest soil, and Palouse silt loam, a cultivated grassland soil.

The data in table 2 show that these two soils which are similar in texture differ greatly in other characteristics. The Melbourne soil is acid in reaction, and although containing nearly twice as much organic matter as the Palouse soil which is about neutral in reaction, it has a much lower nitrifying power. The graphs in figure 3 indicate plainly that the micropopulation consisting of bacteria, fungi, and actinomyces and determined at intervals over a period of more than 3 months is approximately five times as large in the untreated Palouse soil as that in the untreated Melbourne soil. It is noted also that one per cent of finely ground sweet clover hay thoroughly mixed with the soil doubled the micropopulation in both soils, and this stimulated activity which occurred at room temperature was maintained for 50 days.

Even more interesting than the total micropopulation is its composition and the behavior of the three different groups of microbes as a result of increasing the readily available food supply in the soil by the addition of sweet clover hay. This is portrayed by the graphs in figures 4, 5, and 6. It is noted that the bacteria and actinomyces are the dominant groups in the Palouse soil in which their numbers are about six-

TABLE I—NUMBERS OF VARIOUS MICROBES IN AND COMPOSITION OF VIRGIN PEAT AND MANURE

Determinations	Peat soil	Medium decomposed manure
Organic C, per cent	37.10	37.34
Total N, per cent	1.93	2.04
Bacteria, per gram	769,537,000	3,797,239,000
Fungi, per gram	1,871,000	20,000
Actinomyces, per gram	2,760	40,000
Total microbes, per gram	771,410,760	3,747,899,000

TABLE II—REACTION AND COMPOSITION OF UNTREATED SOILS

Soil	pH value	Humus per cent	Nitrogen per cent	Nitrate beginning *p.p.m.*	Nitrogen end *p.p.m.*
Palouse silt loam	6.7	4.43	0.196	26	104
Melbourne silt loam	5.3	8.05	0.249	12	60

fold those in the Melbourne soil. This dominance is even more pronounced when one per cent of sweet clover hay is added to the soil, for such a treatment caused a twofold increase in bacteria and actinomyces in the Palouse soil during the first 50 days, and a much smaller increase in the Melbourne soil.

It is evident also that the fungi are much more numerous in the Melbourne soil than in the Palouse soil and that the addition of sweet clover hay, while resulting in more than double the number of fungi in the Palouse soil, caused more than a tenfold increase in numbers in the Melbourne soil. Thus the same food added to two different soils kept under identical moisture and temperature conditions may have entirely different effects on the activity of the microflora in the two soils. Since humus is a product of microbial activity, it stands to reason that different groups of microbes might be expected to produce different types of humus as well as different kinds of decomposition products. The nature of the humus produced and the kind of decomposition

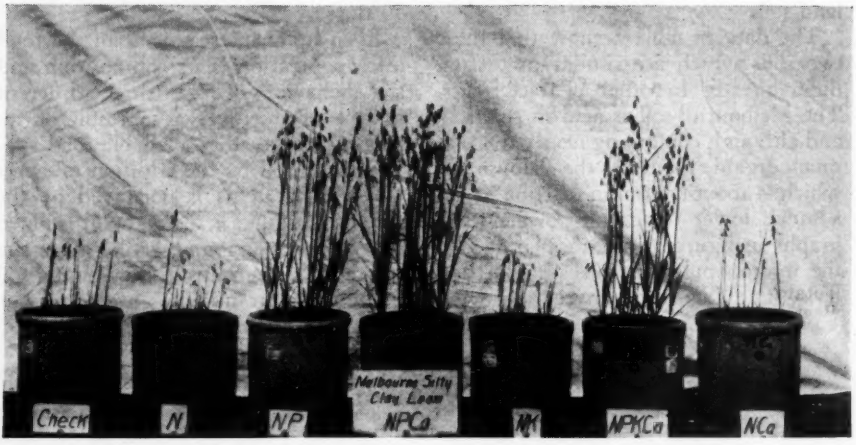


Fig. 7a.—Effect of soil type and fertilizer treatments on the growth of oats (Melbourne Silty Clay Loam).

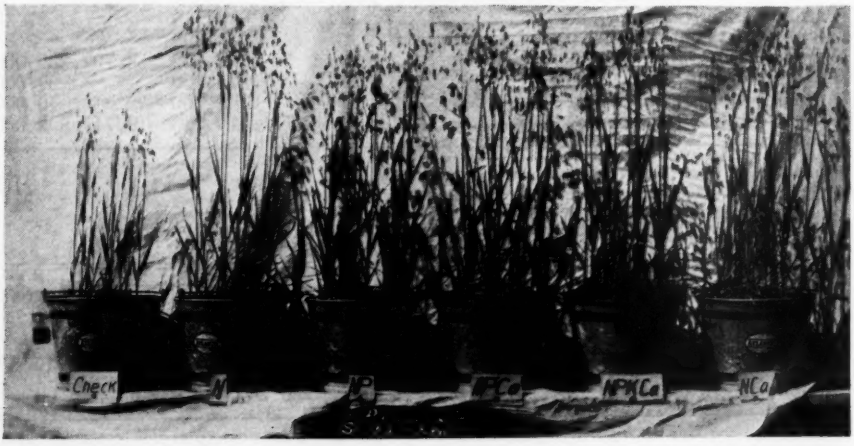


Fig. 7b.—Effect of soil type and fertilizer treatment on the growth of oats (Palouse Silt Loam).

products released by the soil microflora are not only reflected by the development of characteristic inherent physical and chemical soil properties during the process of soil formation but also by the productivity of the soil after it is brought under cultivation.

This is strikingly illustrated in figure 7, which shows that the Melbourne soil with nearly twice as much humus as the Palouse soil but with a microflora in which the fungi take a dominant part is unproductive and does not respond readily to the addition of fertilizers which were applied at the rate of 300 pounds of sodium nitrate, 600 pounds of superphosphate, and 200 pounds of sulfate of potash per acre. The Palouse soil, on the other hand, with half as much humus as the Melbourne soil but with a microflora in which bacteria and actinomyces constitute the dominant groups is highly productive and, as shown in figure 7 (a and b), produces maximum yields of small grain crops when the supply of available nitrogen is adequate.

Many of the characteristic physical and chemical soil properties are imparted by the humus and the organic matter decomposition products, both of which are profoundly influenced by the character of the soil micropopulation. The micropopulation in turn is strongly affected by the character and chemical composition of the plant residues serving as microbial food, so that under a certain set of climatic conditions the kind and amounts of organic residues that are returned to the soil will eventually determine in a significant degree the dominant soil micropopulation that will prevail, the physical and chemical soil characteristics that will be manifested, and the degree of soil productivity which may be expected.

Cows and Cotton

(*From page* 20)

plants, and the average income is $465.00 per family.

Only manufactured products are counted in the tabulations for the last 12 years. Retail milk trade is not included, nor is the milk and cream used by ice-cream and cheese plants. About 10 plants of various types located near by have pushed the dividing line nearer to Starkville, and consequently a lot of milk produced within a 15-mile radius now flows outward. Even the best posted person hesitates to estimate the number of cattle or the amount of milk produced in the original survey area.

Mr. Wirt Carpenter, president of a Starkville bank, recently made some practical studies of how dairying has affected the economic status of the rural and urban sections. He found that the two plants over the 12-year period, dating from 1926, paid to Oktibbeha County dairymen one and one-half times the combined assessed valuation of real and personal property in the towns and county. It amounts to 10 times the bonded indebtedness of the towns and county, including all districts thereof.

Meantime, cotton production has held its own. Per acre production has greatly increased because of soil-improvement practices which grew out of dairying. A majority of the county's acres are in pasture, but the cultivated lands are more productive than were the cotton lands of a quarter of a century ago. Farmers are using more commercial fertilizer as a supplement to the barnyard manure and soil-building crops which they are increasing each year.

While the limestone soils of this immediate area are especially suited to pasture and forage plants, farmers realize that nature needs assistance in the building of pastures—an absolute essential to dairying in the deep South.

"Two strands of barbed wire make a pasture" was once the philosophy of

pasture building in the dairying areas of Mississippi. That is no longer true. Preparation of the land, correct seeding, proper fertilization, and reasonable care are accepted as fundamentals of good pastures. If the dairyman looks after these, nature usually does the rest.

Some of the best land on the farms is being taken out of field crops and converted to pastures. Gullied slopes and non-productive levels no longer are relied upon to furnish grazing. Experience has shown the folly of expecting much of grazing lands that are too poor to produce crops profitably.

Better Quality and Quantity

While dairymen point with pride to the increase in production of whole milk, they are equally proud of the quality of the manufactured product. Only recently, a large New York firm offered to contract with the Cooperative Creamery for the entire output of "A. & M. Butter" at a nice premium over the prevailing market. Officials declined in order to keep serving the early customers who helped them establish a permanent market.

This section, like all others, felt the depression. But it suffered far less than other sections of Mississippi that relied almost wholly on cotton. At the very worst dip in business, about $50,000 was pumped into the rural sections each month, and that money came back to town to help the banker, the baker, the grocer, the professional man, and in fact, every person regardless of the type of work he was doing.

More than any, perhaps, it helps the tenant farmers, most of whom milk only a few cows. Their milk check may not be more than $5, $10, or $15 per month, but it means just that much more cash than they would have were it not for the cows.

Colonel Montgomery may have been a rank eccentric more than a half-century ago, but he's the patron saint of dairying to those who get the check on the 15th of each month and to the business men who love to hear the ring of the cash register when cotton is just beginning to bloom.

And while Oktibbeha Countians label this area "The Dairy Center of the South," the industry has spread out rather uniformly over the State. Better cows, better pastures, and more home-grown feed, which, incidentally mean more profit, are found in every section of the State.

Hundreds of manufacturing plants including condenseries, creameries, ice-cream plants, cheese plants, et cetera, are doing a good year-in-and-year-out business.

Cotton is still king of Mississippi crops, and his throne does not appear to be endangered. However, he plays second fiddle to the dairy cow in at least one county.

Ex-students Extend Ontario's Experiments

(*From page* 17)

being located to cover as thoroughly as possible the different climatic conditions and soil types to be found in the province of Ontario. Very definite information is being secured as to the relative suitability of the varieties for the soil climatic zone in which the test is located. When such information is supplemented by the opinion of the farmers secured through the wider-distributed, smaller plot test, much valuable information is secured regarding the placement of varieties.

The whole scheme of taking information secured at the Experimental Station to the different sections of the country seems to be well-justified and a reasonable way of getting the most from the investigational endeavors being undertaken at any station.

Picnics - Pro & Con

(*From page* 5)

We didn't tire our eyes and get drowsy staring at glaring cement roads, and so we could use all our senses to enjoy the beauties nature set before us. It is true that the auto provides one with a chance to get into other soil types which produce different flora than the woods at home. But the birds, the crickets, the ants, and the worms seem much the same wherever you lay the cloth, and they do the same old things to it.

You can't play Injun any more on ordinary de luxe picnics such as many of our public parkways cater to. You find the kindlings already gathered, a stone fireplace erected, and a shelter house with a radio in it, probably paroled by forest rangers or triple C boys. Not much left to the imagination, and you can't work up an appetite stumbling around collecting chips and chiggers. Receptacles are on every side to catch your empty marshmallow tins and egg shells. You might just as well stay home and picnic in the parlor.

WE don't go on family picnics as often as we did back in the horse and buggy days. Group picnics of varying size and complexion seem to have edged out the old relations-reunions. I haven't been on a family picnic myself for six years, mostly because our youngsters have attained the keeping-company age and each boasts his own younger set who want to be free to go bare-legged and subsist on a case of coke and tater chips.

Besides they have the hostel craze now, and this shuts out the elders completely. They have maps and routes worked out in chains and loops and stop overnight in chicken coops for the boys and machine-sheds for the girls, after doing a day's jaunt that would wring misery from us older folk. This simmers the family picnic affair down to mother and me—and we don't get the kick out of holding hands on an ant-hill like we used to.

Funny thing about the ways of youth a-picnicking! They will hike and sweat along, loaded down with knapsacks and other junk, or get muscle-bound pumping a high-geared bike over a small mountain—for fun. But on ordinary home errands and during school time they take umbrage in big chunks if you won't let them use the car to travel four blocks. However, I reckon they take after us, as we have always been jewels of inconsistency.

RETURNING to discuss family picnics, the last one we took as a clan was out at Great Falls park northwest of Washington, D. C. It seemed good to summon the old friends in three families from our native county and take a day off away from bureau chiefs and "stenographic pools." We tottered over the swing bridge, down through the marsh, and mounted the ridge where the old mill and blast furnace were built by General George in his era of financial promoting. We gawked at the frothy falls foaming over the black rocks below, and took a ride on the whirligig. While the women fussed around with the lunches, the men folks re-created old rural scenes of the home State by engaging in a lively game of horseshoes. Only one of us was fit to be a competitor with the lads from out in the silo series, but we aimed at the pegs and hit our shins with the abandon of licensed amateurs. Really I don't presume we three clans will ever go on an outing together again—and we never had before. It was just a common background of mutual experiences in the same region that gave that event a red-letter mark in my long list of meaningless picnics, most of which are completely forgotten—like the mosquito bites.

Family recreation jaunts, or even foursomes or duets perhaps, strike me as having considerable advantage over the large group or community picnics, where speech making is common. I'd rather come home weary of tending somebody's kid while its Ma picked flowers than to return fagged out from whiffing a sickish rhetorical nosegay. At least I make it a rule to drive my own bus to any outdoor conclave where declamation follows dessert. It enables me to get away before they start wind-jamming, and perhaps spoil a little of it by racing my engine out of a hummock hole. It may have been more or less of a picnic up to then, but not any later. So I quit.

YET in the presence of this unfailing custom, I am no doubt a radical misanthrope. For no lodge, church, or cattle-breed picnic in my province ever concludes without a chairman raising his hand and clearing his throat. The committee in charge may forget to get soft planks for the old ladies, beer for the Swiss yodlers, or cones for the kids, but they never overlook the oratory. It's no job to find orators, for the list of eager speakers is long and tiresome. Next year, in 1940, we will be obliged to stifle them with clubs, or call off the picnics.

Of course at church outings you expect that. You go there deliberately as everybody does laden with cold chicken —and wherever there is cold chicken and a helpless crowd you are bound to find a couple of deacons and an elder. But my one solace comes at the thought that they seldom pass the collection plate at picnics. For once you don't have to pay for listening.

Before the days of electric public address systems one might wander off to the back rows to play mumbletypeg and defy any ordinary stupefier to reach you, no matter how red-faced he got. But nowadays they quickly hook up the spiel box and adjust the mike mouth-high, and then blast the acorns and hickory nuts off of every tree for twenty rods. No retirement or seclusion wards it off. You have to take it anywhere on forty acres, regardless of how much you are concerned personally with the proper regalia for a drill team or the iniquitous free items in the reciprocal trade agreements.

The act of sitting down to a picnic meal in the wilderness, where you cook your own brigand steaks and catch your fish and fry them, is one thing; and a lunch-box squatting party around a tablecloth on the sod is another thing. Then the third thing is a "garden party" a la Canada or England, where you sit on folding chairs at dangerous angles and balance tea and crumpets, doing all gesturing with your mouth. Men enjoy the first kind principally. Women of embonpoint and rheumatism despise the second kind, because they have to be helped up afterwards. The third kind is the realm of society dames and the horror of hungry men.

As to the menu itself and ways to serve it, my experience leads me to suggest that you put it all into a cocktail shaker and be done with it.

I do not think we can fully appreciate the hardships and stoicism of the redskin aborigines in their management of family affairs amid hostile nature until we have gone on a regular dirt picnic. On the whole a little grit and discomfort is good for us once in awhile. We'll grumble a little less indoors.

MY advice is to knock off the daily grind and join some outbound party that intends to live off of salads and scenery a few hours. Possibly some childish reminiscence will steel you to make the sacrifice. You will return tired of some things but rejuvenated elsewhere. The change will work wonders in your digestion and disposition. I do not say in what way, that's an individual matter. But a change is good just the same, barring ptomaine. You'll have something to think about and scratch about. Among other things, the sanity and fitness of nature's plan will astonish you.

DISAPPOINTMENT

"All right back there?" called the conductor from the front of the car.

"Hold on!" came a feminine voice. "Wait till I get my clothes on."

The entire carful turned and craned their necks expectantly. A girl got on with a basket of laundry.

Counsel (to police witness): "But if a man is on his hands and knees in the middle of the road, does that prove he is drunk?"

Policeman: "No, sir, it does not, but this one was trying to roll up the white line."

The will was opened and read by the lawyer, as the widow listened in rapt attention.

"To my beloved wife I bequeath all my property, both real and personal," read the lawyer, "including my pants, which she has wanted to wear for thirty-five years."

TIME AND TIDE . . . .

A fly was walking with her daughter on the head of a man who was very bald. "How things change, my dear," she said. "When I was your age, this was only a footpath."

In a crowded car the other day sat a very thin woman evidently quite uncomfortable by the pressure of a very fat one who sat next her.

Turning to her neighbor she acidly remarked: "They really should charge by weight on these cars."

The fat woman sniffed: "If they did, dearie," she commented, "they couldn't afford to stop for some people."

First Little Girl: "Doctor Jones brought our baby."

Second Little Girl: "We take from him, too."

THE JUDGE'S DECISION

"There ain't any justice in this here land
I just got a divorce from my old man.
And I had to laugh at the judge's decision—
They gave him the kids and they ain't even his'n."

Two Negro maids bought new hats. Liza was determined to wear hers to the Sunday service, but Mandy remonstrated, saying it was going to rain, and declared she'd save hers.

Liza, however, wore hers and, as Mandy predicted, it did rain. As they left the church, Liza gathered up her skirts and pulled them over the hat to protect it.

"Land's sake," exclaimed Mandy. "It's puffectly outrageous foh yo' all to 'pose your anatomy dataway, Liza, and on Sunday, too!"

"Mebbe so," replied Liza, "but dat 'natomy am 40 years old while dis hat am brand new."

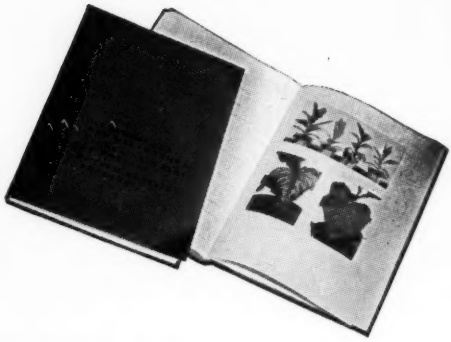
A tramp knocked on the door of the inn known as "George and the Dragon." The landlady opened the door, and the tramp beseeched:

"Could you spare a poor, hungry man a bite to eat?"

"No!" and she slammed the door.

A few minutes later the tramp knocked again. The landlady came again. He asked: "Could I have a few words with George?"

POTASH DEFICIENCY SYMPTOMS



By **ECKSTEIN - BRUNO - TURRENTINE**

(248 pages, in German, French, and English—profusely illustrated with 55 plates in 4 colors and 41 striking figures in black and white.)

THIS publication *presents* comprehensive information on characteristic potash deficiency symptoms appearing on 45 of the most important cultivated crops. Comments accompanying each color plate make this a very practical hand-book for identifying potash starvation.

. . . "It is a valuable reference book for growers, students of vocational agriculture, and for extension workers."—H. H. Zimmerley in *Market Growers Journal.*

. . . "This book is an elaborate and attractive publication, and is destined to meet a keenly-felt want by instructors and research workers, as well as practical growers, in agriculture and horticulture all over the world." —*The Fruit Grower.*

. . . "This is a most commendable form of placing before the peoples of the world the facts regarding potash as a necessary plant food."—C. A. Shull in *Botanical Gazette.*

. . . "This publication is exceedingly valuable in that it brings together material from scores of research institutions, and presents accurate descriptions and illustrations. The collection of plates could not be assembled by any individual except at great expense, and the cooperating potash organizations have rendered valuable service to agriculturists in presenting this work at such a moderate charge."—C. S. T. A. *Review.*

. . . "The volume contains a valuable study of deficiency symptoms, strikingly illustrated."—H. P. Cooper in *Journal American Society of Agronomy.*

. . . "Any one interested in the mineral nutrition of plants will be glad to study this interesting treatise on potash deficiency in plants."—A. R. C. Haas, in *California Citrograph.*

A leaflet in the original size of the book, containing more detailed information, will be sent free upon request.

Bound in half leather . . . . . Price $2.25

B. WESTERMANN CO., INC. 20 West 48th St., New York, N. Y.

Printed in U.S.A.